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FINAL
FIVE-YEAR REVIEW REPORT
Third Five-Year Review Report

for

Keefe Environmental Services Site
Epping, NH

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Epping, NH

March 2003

Prepared by:

U.S. Environmental Protection Agency
Region 1
Office of Site Remediation and Restoration

Approved by:

Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration

Date:

3/26/03

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLan)*: Keefe Environmental Services

EPA ID *(from WasteLan)*: NHD092059112

Region: 1	**State: New Hampshire**	**City/County: Epping/Rockingham**

SITE STATUS

NPL Status: **Final** Deleted Other (specifiy)

Remediation status (choose all that apply): Under Construction **Operating** Complete

Multiple OUs?* **YES** NO	**Construction completion date:** 9/21/1994

Has site been put into reuse? YES **NO**

REVIEW STATUS

Lead agency: **EPA** State Tribe Other Federal Agency

Author name: Cheryl Sprague

Author title: Remedial Project Manager	**Author affiliation: EPA**

Review period:*** 9/6/2002 to 3/26/03

Date(s) of site inspection: 11/4/02

Type of review:

Post-SARA Pre-SARA NPL-Removal only
Non-NPL Remedial Action Site NPL State/Tribe-lead
Regional Discretion

Review number: 1(first) 2 (second) **3 (third)** Other (specify) _____

Triggering action:

Actual RA Onsite Construction at OU #_____ Actual RA Start at OU #_____
Construction Completion **Previous Five-Year Review Report**
Other (specify) _____

Triggering action date *(from WasteLAN)*: 9/29/1997

Due date *(five years after action date)*: 9/29/2002 extended to 3/31/2003

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd

Issues:

1. Concentrations of COCs in the 1988 ROD still remain at or above the ROD target cleanup goals at limited areas of the site; however overall, a downward trend is observed for groundwater concentrations, indicating that the remedy has been successful at reducing the aerial extent of the groundwater plume and removing contaminant mass.

2. Additional COPCs not identified during the 1988 ROD have been identified based on current detections in groundwater. A risk-based review of these chemicals and potential exposure pathways should be conducted at the completion of the remedial action.

3. Institutional controls are not part of the current remedy. If land use changes occur in the future under NHDES lead, then institutional controls may become necessary. If the groundwater extraction system is discontinued before cleanup goals are attained, institutional controls to restrict future groundwater use may be necessary.

4. If the future site use changes, a re-evaluation of a future site worker or future trespasser scenario for direct contact of the on-site soil stockpile may be necessary. This will require collection of soil samples from the filled lagoon.

5. Several monitoring wells require maintenance or repair. In addition, inactive wells need to be formerly decommissioned.

6. Advances in in-situ treatment technologies have been made since 1997 implementation of the pump and treat system. A re-evaluation of alternative in-situ treatment technologies should be reviewed.

Recommendations and Follow-up Actions:

1. Continue groundwater monitoring and conduct an evaluation of alternative in-situ treatment technologies and/or removal actions.
2. Evaluate institutional controls to reflect potential future site conditions.
3. Repair damaged wells and secure unsecured wells.
4. Formerly decommission inactive wells.
5. Review ARARs for new groundwater compounds of potential concern.
6. Collect soil samples from the on-site stockpile. Evaluate a future trespasser/future site worker direct contact exposure scenario.

Protectiveness Statement(s):

The remedy at OU-1 has met soil cleanup goals, is complete and therefore is protective of human health and the environment. The pump and treat remedy at OU-2 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could results in unacceptable risks are being controlled.

Other Comments:

None

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1. INTRODUCTION

The purpose of this five-year review is to determine if the remedy selected for the Keefe Environmental Services (KES) Superfund Site (Site) in Epping, New Hampshire is protective of human health and the environment. This report summarizes the five-year review process, investigations, and remedial actions conducted at the site, evaluates the monitoring data collected at the site, discusses issues identified during the review, and presents recommendations to address them.

This five-year review was initiated on September 6, 2002 and is the third five-year review for the KES Site. The first and second five-year reviews were completed in February 1993 and September 1997, respectively.

The United States Environmental Protection Agency, Region 1 (USEPA) has prepared this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> "If the president selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The USEPA further interpreted this requirement in the NCP; 40 CFR §300.430(f) (4) (ii) states:

> "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

The Site was separated into two operable units (OUs):

- OU-1 (Lagoon and Surrounding Soils): and
- OU-2 (Groundwater).

USEPA signed a Record of Decision (ROD) for OU-1 on November 15, 1983 which mandated decommissioning of the lagoon and removal of the lagoon contents. USEPA signed a ROD for OU-2 on March 21, 1988 which included both source control and management of migration components. The source control component consisted of vacuum enhanced extraction for soils. The management of migration component included pumping and treating of groundwater to remove site-related volatile organic compounds (VOCs). On June 8, 1990, USEPA issued an Explanation of Significant Differences (ESD) for the site to remove the 1988 ROD requirement of soil vacuum extraction because subsequent sampling showed that the concentrations of contaminants in the soils were already below the soil cleanup standards.

2. SITE CHRONOLOGY

This section presents a chronology of events that have taken place at the Site. Events are presented in chronological order in **Table 1**.

TABLE 1: CHRONOLOGY OF SITE ACTIVITIES

Date	Activity
March 29, 1978	Paul Keefe proposes constructing a chemical waste storage and bulking facility to Epping Planning Board
May 31, 1978	Planning board approves plan.
1978	Operations begin including establishing drum storage area, installing storage tanks, equipment shelters, bulking areas, and a synthetically lined lagoon
April 1, 1979	New Hampshire Bureau of Solid Waste Management (BSWM) and Public Health Services order KES to clean-up leaking storage tanks, ruptured drums, contaminated soils, and improperly dumped latex wastes.
May 1, 1979	Pursuant to frequent odor complaints Town of Epping institutes legal action against KES. Town retained Wehran Engineering to perform site investigations. KES retains Environmental Engineers, Inc. to perform an independent assessment.
July 1, 1979	New Hampshire Hazardous Waste Law becomes effective.
September 1979	Wehran Engineers begin hydrogeologic investigation at the site.
September 27, 1979	BSWM begins well sampling program at KES and local residences.
October 16, 1979	Water Supply and Pollution Control Commission (WSPCC) begins separate sampling program including streams. Carbon tetrachloride and chloroform were detected in the stream northwest of the site.
November 1979	State issues second cleanup order stating chlorinated hydrocarbons were present in KES wells. WSPCC begins sampling residential wells. KES installed four new monitoring wells.
December 1979	KES files motion for rehearing claiming the cleanup order was unreasonable. WSPCC issued wetlands violation against KES for filling of wetland during installation of monitoring wells.
January 1980	State claims violation of NH Hazardous waste regulations and files petition in court for mandatory injunction and civil penalties against KES.
April 23, 1980	Court order establishes ground rules for continued operation of the Keefe site.
June 5, 1980	Attorney General's Office notifies Keefe of the State's recommended sampling and analysis procedures for KES wells and nearby surface waters.
September 9, 1980	Master's report (Town of Epping and State of NH vs. Paul A. Keefe et al) reiterates areas of non-compliance of the previous clean-up order.
January 1981	KES files for bankruptcy protection and abandons site. EPA institutes cleanup actions at the site via Ecology and Environment' Technical Assistance Team
February 1981	EPA declares and emergency at the KES site due to potential for lagoon to overflow. The EPA's FIT Contractor begins site investigation and lagoon berm stabilization.
April 1981	Rising spring temperatures cause rupture of drums and release of drum contents to the ground. EPA engages Marlyn Engineering to begin drum stabilization.
August 13, 1981	FIT submits Preliminary Assessment Report.
December 15, 1981	FIT performs site inspection.
January 7, 1982	FIT performs site inspection.
January 13, 1982	FIT submits Assessment of Alternatives for Temporary Stabilization of Lagoon.
March 24, 1982	FIT submits proposed work plan for future actions
July 1982	EPA engages a contractor to remove imminent health hazards, storage tank contents, and dumpsters.
September 1982	EPA determines that initial remedial measures are appropriate for the site and notifies contractor to prepare Remedial Action Master Plan (RAMP).
October 1982	RAMP was submitted.
March 1983	Resource Technology Services, Inc. under contract to the WSPCC initiated removal of bulk drummed waste from the site.
July 13, 1983	Tighe & Bond engaged by WSPCC to perform the remedial investigation (RI) and to prepare lagoon justification and lagoon decommissioning bid documents.
August 26, 1983	Drum and bulk waste removal contract completed.
September 8, 1983	KES site listed on the National Priority List (NPL)
November 4, 1983	D' Appolonia Waste Management Services was engaged by WSPCC to remove lagoon contents and decommission the lagoon.
November 15, 1983	EPA issues Record Of Decision (ROD) for OU-1 which mandates decommissioning of the lagoon and removal of the lagoon contents.
February 1984	Lagoon decommissioning project completed.

TABLE 1: CHRONOLOGY OF SITE ACTIVITIES

Date	Activity
June 1984	Remedial Investigation (RI) for OU-2 submitted to NH WPSCC by Tighe & Bond.
October 1984	Revised RI for OU-2 submitted to NH WPSCC by Tighe & Bond.
April 1985	Revised RI for OU-2 submitted to NH WPSCC by Tighe & Bond.
January 13, 1986	Summary of Existing Data submitted to WSPCC by CDM.
May 13, 1986	Draft RI submitted to WSPCC by CDM.
September 1986	Supplemental RI Report for OU-2 at the site submitted to WSPCC by CDM.
December 1987	Supplemental RI Report for the site submitted to NH Department of Environmental Services (NHDES) by CDM. Draft Feasibility Study submitted to NHDES.
March 21, 1988	EPA issues ROD for OU-2 which included both source control and management of migration components. Source control consisted of vacuum enhanced extraction. Management of migration included pumping and treating of groundwater to remove VOCs.
April 1989	Draft Preliminary Design Data Evaluation Report submitted to NHDES by CDM.
April 16, 1990	Draft Project Operations Plan for Additional Off-Site Investigations submitted to EPA by NHDES.
June 7, 1990	Draft Project Operations Plan for Additional Off-Site Investigations approved by EPA.
June 8, 1990	EPA issues an Explanation of Significant Differences (ESD) for the site, to remove the 1988 ROD requirement for soil vapor extraction, because subsequent sampling showed lower soil concentrations revealing no need to implement the soil vapor extraction portion of the remedy.
January 1991	Draft Off-Site Hydrogeological Evaluation Report for the KES submitted to NHDES by CDM.
Nmarch 1991	Draft Off-Site Hydrogeological Evaluation Report for the KES submitted to NHDES by CDM.
1991 to 1992	Groundwater Collection and Treatment Facility design completed by CDM
1992 to 1993	Groundwater Collection and Treatment Facility construction completed by R. Zoppo, Inc.
February 22, 1993	The first five-year review report was issued by EPA.
April 1993	Groundwater Collection and Treatment Facility Start-up commenced.
September 1993	Long-term remedial action of Groundwater Collection and Treatment Facility initiated.
1994	Woodard & Curran initiated a hydrogeologic evaluation and proposed location for two new extraction wells (groundwater modeling and test well program completed)
September 1995	The pump and treat system was optimized by the removal of two wells and the addition of two new wells 95-2 and 95-7. The locations of the new wells were selected to increase extraction rates and mass flux to the treatment plant.
September 1997	The second five-year review report was issued by EPA, and stated that the remedy remained protective of human health and the environment.
August 1998	Installation and activation of three on-site vacuum enhanced recovery wells completed.
September 6, 2002	Third five-year review and report initiated by Woodard & Curran for the EPA.

3. BACKGROUND

3.1 PHYSICAL CHARACTERISTICS

3.1.1 Setting

The KES Superfund Site property consists of approximately seven acres and is located in Epping, New Hampshire just off Exeter Road (Old Route 101), as shown in **Figure 1**. The Site is approximately two miles southeast of the municipal center, north of Exeter Road and south of the Piscassic River. The Site is bordered to the west by a defunct chicken farm and to the east by the New England Dragway. Two intermittent streams are adjacent to the Site. The first stream drains a wetland area northwest of the Site and flows northwesterly toward the Piscassic River via a small brook. The second intermittent stream receives drainage from other areas of the Site and flows eastward from a wetland area south of the Site toward the Fresh River.

3.1.2 Topography

The topographic relief of the Site is low to moderate. Elevations vary from a height of 160 feet above mean sea level (MSL) in the northeast corner of the Site to a low of 126 feet above MSL in a wetland to the southwest. The majority of abrupt changes in elevation on the Site are due to excavation and filling activities that have occurred. Till materials at the Site have been excavated from an embankment on the northeast corner of the Site and used for multiple purposes, including filling portions of the site to enhance drainage; road construction; leveling former drum storage areas; and waste lagoon dike construction.

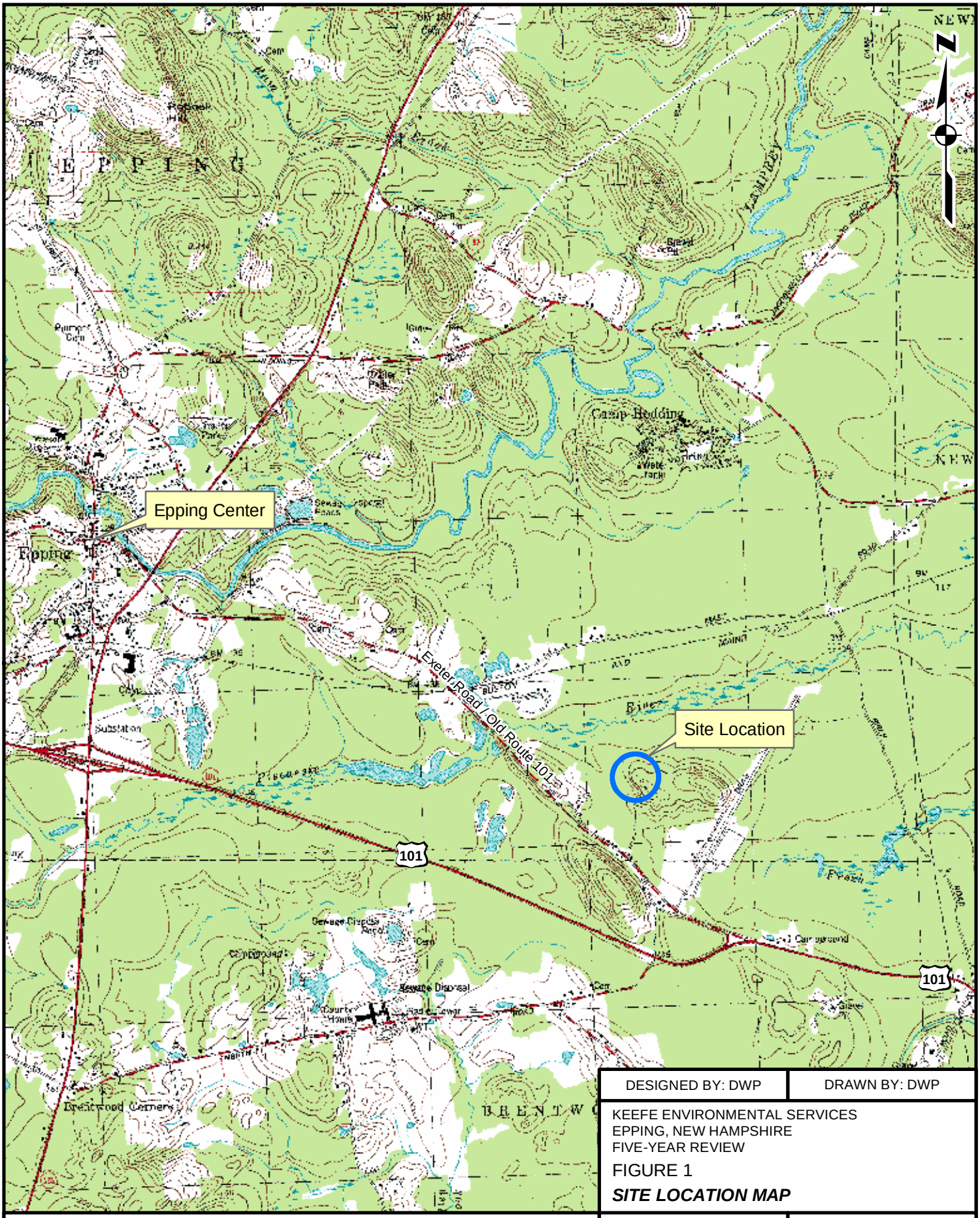
3.1.3 Subsurface Conditions

The Site is located on the northern end of a glacial deposit composed of glacial till approximately 20 to 120 feet thick. This glacial till is surrounded by stratified silty fine to medium sands. These sands are interpreted as outwash deposits and pinch out against the flanks of the till uplands. The outwash deposits are overlain by thin silt and clay varying in thickness from 0 to 15 feet.

The stratigraphic positioning of the clays over the outwash sand creates confined conditions in the outwash sand. The potentiometric surface for groundwater occurring in the outwash sands is at the ground surface in spring and early summer. Groundwater flows through the till and discharges vertically to the outwash deposits. Downward hydraulic gradients are observed in the till. Upward hydraulic gradients are observed in the outwash deposits. The upward groundwater gradients and the dense underlying till beneath the outwash deposits form a hydrogeologic barrier to the downward migration of contaminants from the Site. Therefore, groundwater contaminants are not believed to have entered the bedrock flow regime within the natural unstressed groundwater flow system.

3.2 LAND AND RESOURCE USE

The Site is currently a combination of open space, forested uplands, and forested lowlands with an active groundwater pump and treat facility on the property. The site and surrounding area is currently zoned as commercial/light industrial. The surrounding properties are currently mixed commercial and residential. The commercial properties nearby include an active recycling/composting facility, a drag racing facility, and a federal firearms training facility. The remainder of the area is rural in character. Approximately 12



0 1,000 2,000 4,000 6,000 Feet

DESIGNED BY: DWP	DRAWN BY: DWP

KEEFE ENVIRONMENTAL SERVICES
EPPING, NEW HAMPSHIRE
FIVE-YEAR REVIEW

FIGURE 1

SITE LOCATION MAP

SCALE: 1" = 2500'	JOB NO.: 217000.01
DATE: MARCH 2003	DOC: LOCMAP.MXD

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residences are located on Exeter Road south of the Site. The Site is secured by a perimeter fence in good condition. It is anticipated that the potential future site use will be industrial/commercial.

The Site includes both terrestrial and aquatic habitats. Wetland areas were mapped during the Supplemental RI. There are no known endangered or threatened species at the Site. There are no significant sand and gravel aquifers mapped at the site.

3.3 HISTORY OF CONTAMINATION

The KES Site operated as a chemical waste storage and bulking facility from 1978 until 1981, when the facility owners declared bankruptcy. Waste storage containers abandoned at the Site included 4,100 drums, four 5,000 gallon above ground storage tanks, four 10,000 gallon above ground storage tanks, seven dumpsters containing sludges and contaminated soils, and a 700,000 gallon lined storage lagoon. Solvents, acids, caustics, heavy metals, paint sludges, waste oils, and organic chemicals were disposed at the site. Soil and groundwater contamination consisted primarily of VOCs.

3.4 INITIAL RESPONSE

In 1981, USEPA declared an emergency because the lagoon was about to overflow (see lagoon location on Figure 2). USEPA and the New Hampshire Department of Environmental Services (NHDES) removed and treated the liquid wastes in the lagoon. The lagoon berms were stabilized in February of 1981 and liquid levels were reduced in March. Drum stabilization and removal activities began in 1981 and continued during 1982. USEPA signed a ROD for OU-1 (Lagoon and Surrounding Soils) on November 15, 1983 which mandated decommissioning of the lagoon and removal of the lagoon contents. In 1983 and 1984, the USEPA and the state removed all of the waste, containers, lagoon waste, and contaminated soils adjacent to the lagoon and disposed of them at a regulated facility.

USEPA signed a ROD for OU-2 (Groundwater) on March 21, 1988 which included both source control and management of migration components. The source control component consisted of vacuum enhanced extraction for soils. The management of migration component included pumping and treating of groundwater to remove site-related VOCs. On June 8, 1990, USEPA issued an ESD to remove the 1988 ROD requirement of soil vacuum extraction because subsequent sampling showed that the concentrations of contaminants in the soils were already below the soil cleanup standards at the time the ROD was issued.

However, in 1992, the NHDES lined the former lagoon and placed excavated contaminated soil from the extraction trench into the lined lagoon. Rainfall was allowed to percolate through the soils, collect on the liner, and leached water was piped to the groundwater treatment plant for treatment. No additional remediation for these soils has been conducted at the Site.

3.5 BASIS FOR TAKING ACTION

The hazardous substances that have been released to the Site are primarily chlorinated and non-halogenated VOCs. Based on the compounds detected during site investigation activities, contaminants of concern (COCs) were identified in the 1988 ROD. The COCs for both soil and groundwater were identified as benzene, tetrachloroethylene (PCE), trichloroethylene (TCE), 1,2-dichloroethane (1,2-DCA), and 1,1-dichloroethylene (1,1-DCE). These COCs and ROD-specified clean up goals are presented by medium in **Table 2**. These cleanup goals were established based on achievable drinking water standards in groundwater.

TABLE 2: MEDIA SPECIFIC CLEANUP GOALS FOR CONTAMINANTS OF CONCERN

Contaminant by Media	Cleanup Level (ppb)
Soil	
Benzene	20.8
Tetrachloroethylene	91
Trichloroethylene	31.5
1,2-Dichloroethane	3.5
1,1-Dichloroethylene	22.8
Groundwater	
Benzene	5
Tetrachloroethylene	5
Trichloroethylene	5
1,2-Dichloroethane	5
1,1-Dichloroethylene	7

4. REMEDIAL ACTIONS

This section discusses the selection and implementation of remedial actions.

4.1 REMEDY SELECTION

The remedial action specified in the March 21, 1988 ROD established cleanup goals for both a Source Control Component (soils) and a Management of Migration Component (groundwater).

4.1.1 Source Control

The Source Control Component consisted of the following remedial response objectives for soils:

- Prevent or mitigate the further release of contaminants to surrounding environmental media;
- Eliminate or minimize the threat posed to public health, welfare, and the environment from the source area; and
- Reduce the volume, toxicity, or mobility of hazardous substances, pollutants, and contaminants.

These source control objectives resulted in the establishment of the soil cleanup goals as previously listed in **Table 2**. The objectives also prompted USEPA to select vacuum extraction as the remedy for source control in the 1988 ROD. Pre-remedial design studies, however, indicated that natural attenuation and migration of soil contamination to groundwater had occurred to the extent that soil contaminant concentrations were reduced below cleanup goals. Based on this data, the USEPA issued an ESD on June 8, 1990 that eliminated the requirement for the installation of a vacuum extraction system. In 1992, the NHDES lined the former lagoon area and placed excavated contaminated soil from the extraction trench into the lined lagoon. Rainfall was allowed to percolate through the soils, collect on the liner, and leached water was piped to the groundwater plant for treatment. No additional action for these soils has been conducted.

4.1.2 Management of Migration

The Management of Migration Component of the remedy consisted of the following remedial response objectives for groundwater:

- Preventing or mitigating migration of contaminants beyond their current extent; and
- Eliminating or minimizing the threat posed to public health through ingestion of contaminated groundwater.

The remedy selected by USEPA to meet these objectives for Management of Migration consisted of the following:

- Pumping of contaminated groundwater from the aquifer;
- Treating extracted water on-site using air stripping, filtration, and carbon absorption; and
- Re-infiltrating treated water to the aquifer.

4.2 REMEDY IMPLEMENTATION

Activities completed during the implementation of ROD are described in this section.

4.2.1 Source Control

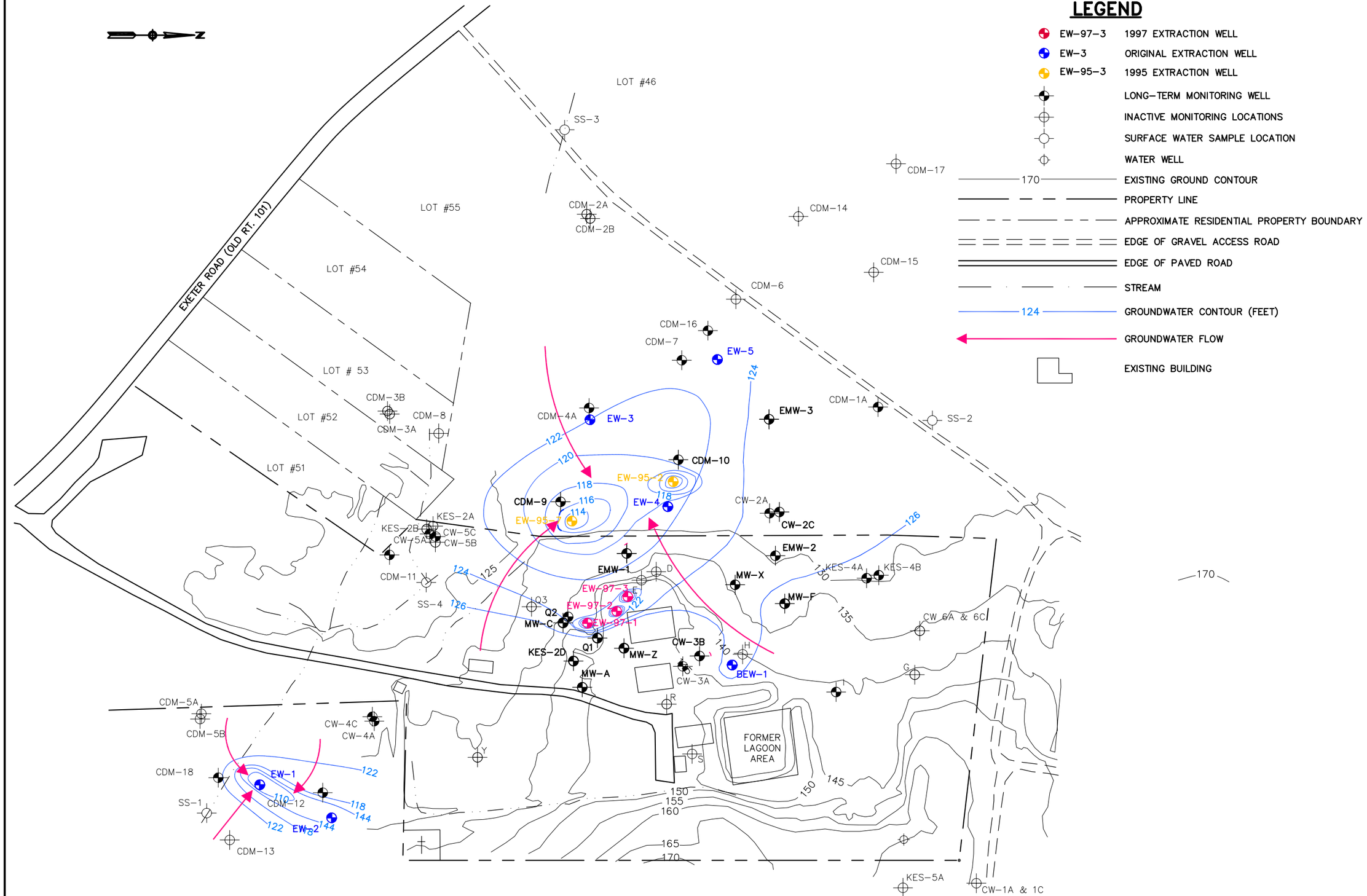
The remedy selected in the ROD for source control was vacuum extraction. Pre-design field studies indicated that natural attenuation and migration to site groundwater had reduced the concentration of contaminants in soils to below the cleanup goals. Based on this finding, an ESD was issued for the site that removed vacuum extraction as a remedy component. However, in 1992, the NHDES lined the former lagoon area and placed excavated contaminated soil from the extraction trench into the lined lagoon. Rainfall was allowed to percolate through the soils, collect on the liner, and leached water was piped to the groundwater plant for treatment. No additional action for these soils has been conducted.

4.2.2 Management of Migration

The management of migration component consists of groundwater extraction, treatment, and re-infiltration. When the system construction was completed on June 10, 1993, the system consisted of four wells in the overburden aquifer, one well in the bedrock aquifer, and a groundwater collection trench. In 1995, the groundwater extraction system was optimized by replacing the existing extraction wells with two new extraction wells. The new wells were used to maximize groundwater extraction volumes, thereby increasing contaminant loading to the plant. A groundwater monitoring well network was also installed to measure protectiveness of the remedy. NHDES also semi-annually samples six off-site residential wells located to the south of the Site for VOCs. Since Woodard & Curran began LTRA services in September 19993, none of these residential wells have indicated the presence of VOCs. In 1997, three additional vacuum enhanced extraction wells were installed to further optimize the systems ability to extract and remediate contaminated groundwater, as discussed further in Section 4.2.3. The locations of these on-site extraction wells and monitoring wells, collection trench, infiltration trench, and off-site residential sampling locations are indicated on **Figure 2**.

Since the startup of the groundwater treatment system in June 1993, concentrations of the contaminants in groundwater have decreased in both the monitoring and extraction wells. The aerial extent of the groundwater plume has also been significantly reduced, as depicted in **Figures 3, 4,** and **5.** While isolated pockets of the groundwater plume still exceed the cleanup goals, primarily in the area directly below the former waste handling facility, significant reductions in contaminant concentrations and distribution (e.g. plume size) has been observed.

Statistical analyses of the groundwater data by Mann Kendal trend analyses have been conducted on the historic groundwater data from each well. The Mann Kendall test is an analytical method for identifying statistically significant upward or downward trends. A summary of the Mann Kendall test results are presented in **Table 3**. A review of the Mann Kendal trend tests indicates predominantly downward trends, indicating a reduction in contaminant mass. Only two wells, A and Q-2, both near the former processing areas, have exhibited upward trends. This is most likely associated with the pulling back of the plume toward the center of the treatment area.



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MAY 2001 GROUNDWATER CAPTURE ZONES

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FILE: 93424011-2-5yr/inter

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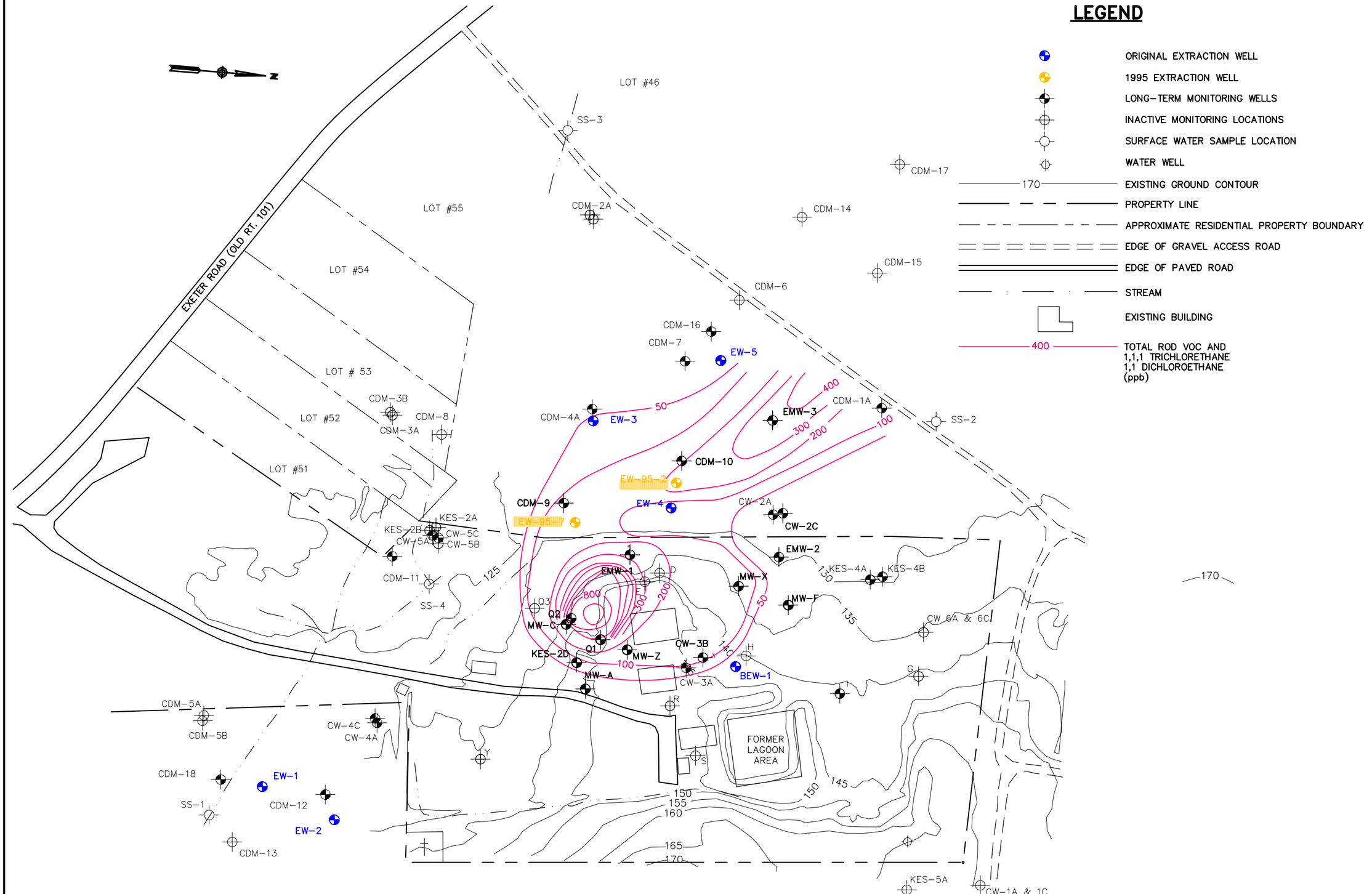
EPPING, NEW HAMPSHIRE

FIVE-YEAR REVIEW

JOB NO: 217000.01
DATE: MARCH 2003
SCALE: 1" = 150'

FIGURE 2



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TOTAL VOC CONTAMINANT DISTRIBUTION – SEPTEMBER 1995

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FIVE-YEAR REVIEW

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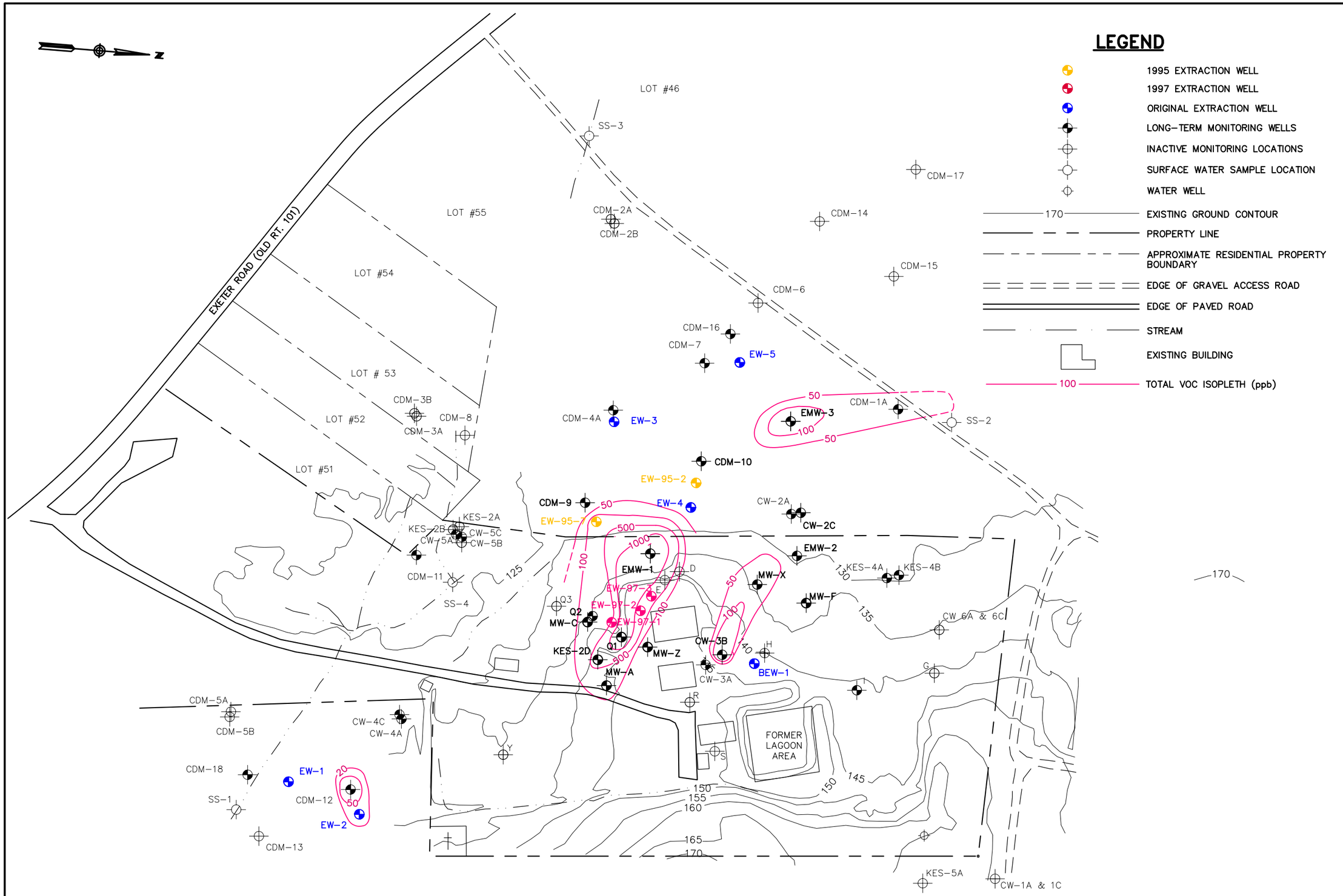
SCALE: 1" = 150'

FIGURE 3



LEGEND

- 1995 EXTRACTION WELL
- 1997 EXTRACTION WELL
- ORIGINAL EXTRACTION WELL
- LONG-TERM MONITORING WELLS
- INACTIVE MONITORING LOCATIONS
- SURFACE WATER SAMPLE LOCATION
- WATER WELL
- 170 — EXISTING GROUND CONTOUR
- PROPERTY LINE
- APPROXIMATE RESIDENTIAL PROPERTY BOUNDARY
- EDGE OF GRAVEL ACCESS ROAD
- EDGE OF PAVED ROAD
- STREAM
- EXISTING BUILDING
- 100 — TOTAL VOC ISOPLETH (ppb)

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TOTAL VOC CONTAMINANT DISTRIBUTION – NOVEMBER 1999

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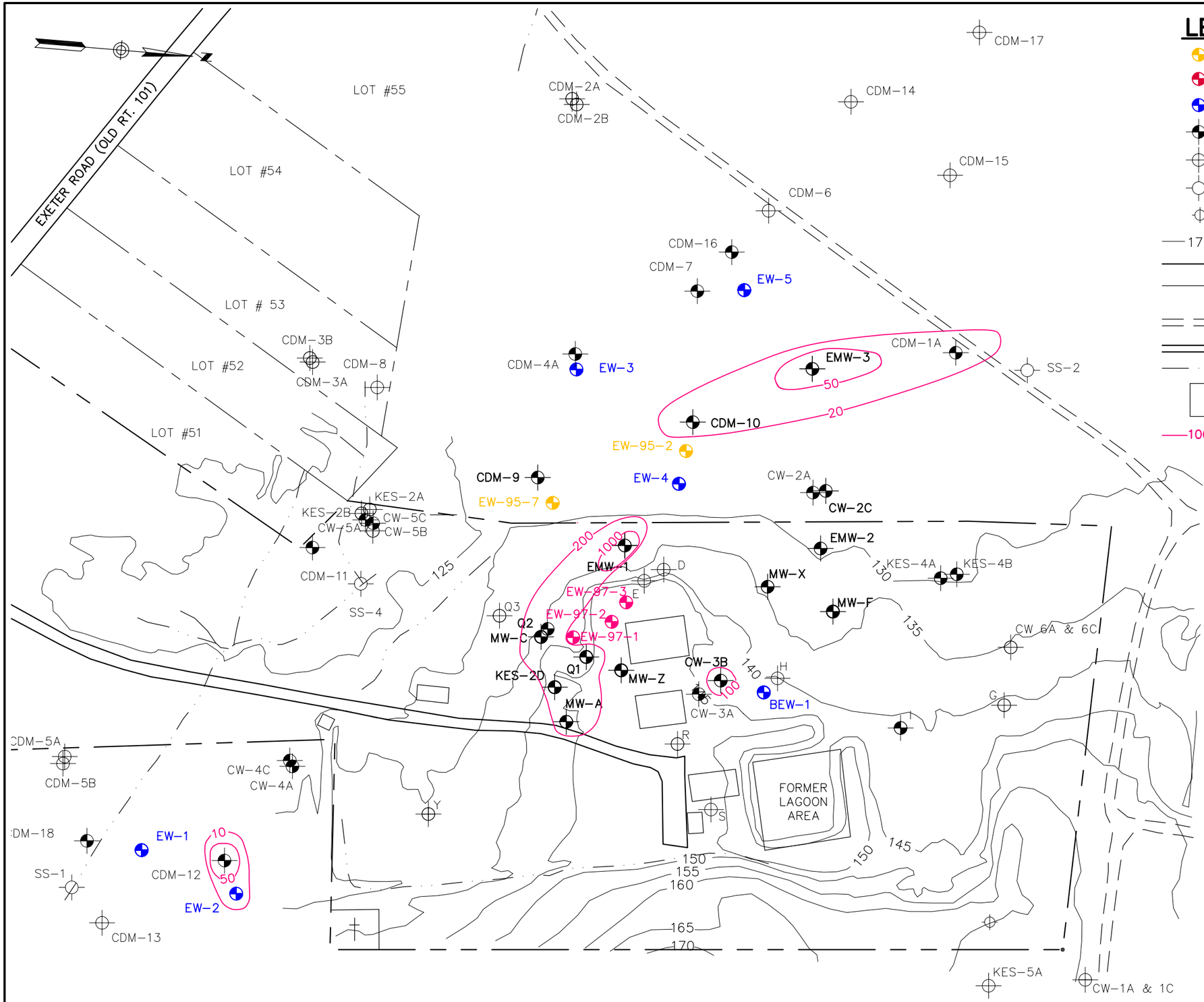
FIVE-YEAR REVIEW

JOB NO: 217000.01
DATE: MARCH 2003
SCALE: 1" = 150'

FIGURE 4



LEGEND

- 1995 EXTRACTION WELL
- 1997 EXTRACTION WELL
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- 170 — EXISTING GROUND CONTOUR
- PROPERTY LINE
- APPROXIMATE RESIDENTIAL PROPERTY BOUNDARY
- EDGE OF GRAVEL ACCESS ROAD
- EDGE OF PAVED ROAD
- STREAM
- EXISTING BUILDING
- 100 — TOTAL VOC ISOPLETH (ppb)

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TOTAL VOC CONTAMINANT DISTRIBUTION - OCTOBER 2001

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EPPING, NEW HAMPSHIRE

FIVE-YEAR REVIEW

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DATE: MARCH 2003
SCALE: 1" = 125'

FIGURE 5

TABLE 3
MANN KENDALL TREND TEST RESULTS
THROUGH OCTOBER 2001

WELL LOCATION	1,1-DCE	PCE	TCE	1,2-DCA	BENZENE	1,1,-DCA	TOTAL UPWARD TRENDS	TOTAL DOWNWARD TRENDS
Monitoring Wells								
A	–	–	–	UP	–	UP	2	0
C	–	–	–	–	–	–	0	0
CDM-10	–	–	–	DOWN	DOWN	DOWN	0	3
CDM-12	–	–	–	–	–	DOWN	0	1
CDM-1A	–	–	–	–	–	–	0	0
CDM-9	–	–	–	DOWN	DOWN	DOWN	0	3
CW-2C	–	–	–	–	–	–	0	0
CW-3B	–	–	–	DOWN	–	DOWN	0	2
EMW-1	–	–	–	–	–	–	0	0
EMW-2	–	–	–	–	–	DOWN	0	1
EMW-3	–	–	–	–	DOWN	–	0	1
F	–	–	–	–	–	DOWN	0	1
KES-2D	–	–	–	–	DOWN	–	0	1
Q-1	–	–	–	–	–	–	0	0
Q-2	–	–	–	–	–	UP	1	0
X	–	–	–	DOWN	DOWN	DOWN	0	3
Z	–	–	–	–	–	–	0	0
Extraction Wells								
BEW-1	–	–	–	–	–	–	0	0
EW-95-2	–	–	–	–	DOWN	DOWN	0	2
EW-95-7	–	–	–	–	–	DOWN	0	1
EW-1	–	–	–	–	–	DOWN	0	1
EW-2	–	–	–	–	–	DOWN	0	1
EW-3	–	–	–	–	–	DOWN	0	1
EW-4	–	–	–	DOWN	DOWN	DOWN	0	3
EW-5	–	–	–	DOWN	DOWN	DOWN	0	3

– No upward or downward trends identified in the Mann Kendall analysis

4.3 SYSTEMS OPERATIONS/LONG TERM REMEDIAL ACTION

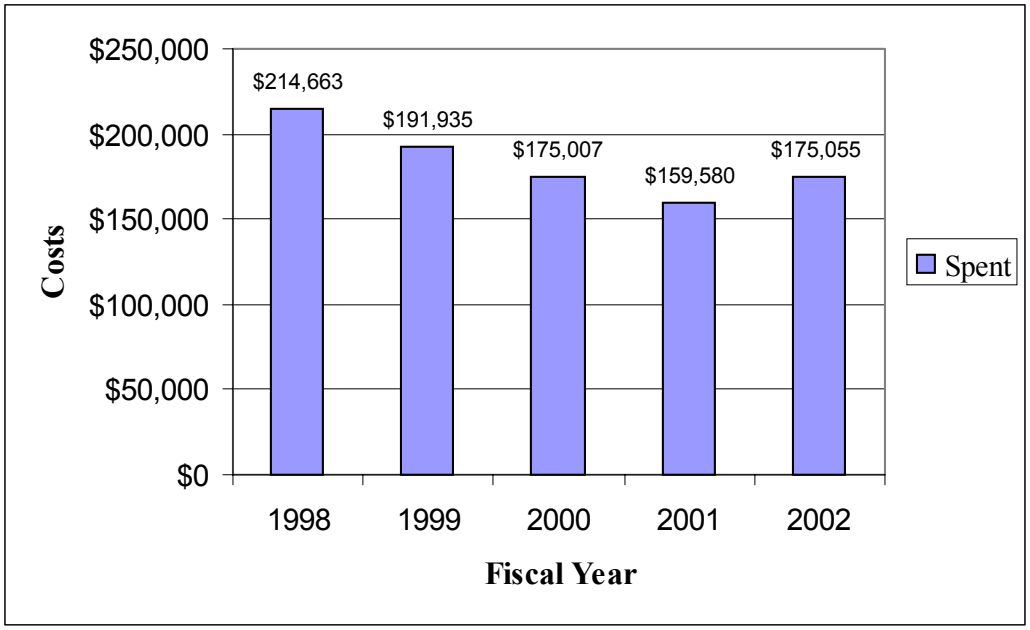
In June 1993, construction of the OU-2 Groundwater Collection and Treatment Facility (GCTF) was completed and system start-up commenced. The system was designed to extract and treat up to 60 gallons per minute (gpm) utilizing metals precipitation, air stripping, vapor phase carbon adsorption, and re-injection/infiltration of treated water. During the startup period, the system was monitored and evaluated to ensure all construction activities were complete and system components were functioning properly. Equipment checks were completed to ensure pumps, motors and control systems were functioning and were mechanically and electrically sound. In September 1993, the NHDES and USEPA awarded a long-term operations contract for the Keefe GCTF. The long-term remedial action (LTRA) project includes full-time site coverage (system operations and maintenance), site security, hydrogeological assessments, and engineering evaluations and recommendations. The contractor has met all performance objectives and significantly improved the performance of the site extraction system to maximize mass flux of contaminants into the facility.

The Keefe GCTF has a number of treatment components and unit processes. At present, these include five groundwater extraction wells, three vacuum enhanced extraction wells, a collection trench, a pump station, metals removal, pressure filtration, air stripping, vapor treatment, sludge dewatering, and effluent disposal (see Figure 2). Groundwater is collected through an on-site groundwater collection trench and an on-site and off-site extraction well network. The original effluent discharge system consisted of an on-site leach field and an off-site infiltration trench. This system has been supplemented with an on-site spray irrigation system to dispose of treated effluent via evapotranspiration.

Originally, the site cleanup was expected to take 10 years at the design flow rate of 60 gpm; however, due to the naturally occurring tight soils at the site, the system was only capable of extracting at 8 to 10 gpm of groundwater from the subsurface; thereby, more than doubling the anticipated cleanup duration. In 1994, the site LTRA contractor completed a hydrogeological evaluation of the aquifer being treated. The study identified design limitations of the existing pumping, collection, and recharge systems. Based on these results, the contractor implemented engineering improvements to the system including two strategically placed extraction wells which significantly increased the effectiveness of the system. These wells were placed on line in September 1995 and in less than two years, monitoring results and hydrogeologic modeling showed approximately a 70% reduction in contaminant plume (off-site) and a five-fold reduction in concentration levels. In addition, the spray irrigation program was initiated in 1995 in an effort to both prevent hydraulic mounding at the infiltration trench and reduce onsite contamination observed in the till surrounding the site. From April through November (weather dependent), an average of approximately 60-90 percent of the treatment plant discharge is diverted from the infiltration trench to the spray irrigation system. The site LTRA contractor also engineered and initiated installation of a Vacuum Enhanced Extraction System (VEES) to further enhance the on-site remediation effort. These wells were installed between 1997 and 1998 (see Figure 2). The vacuum enhanced recovery extraction wells were started-up and placed on-line in August 1998 and are expected to further optimize the removal of contaminated groundwater at the Site.

Optimization of the groundwater remediation system has accelerated the initial site remediation progress but also reduced of base operating costs, which have decreased since the first year of operation (see **Figure 6**). These optimization projects (chemical, electrical, sampling and analysis, etc.) have enabled the costs of the project to decrease each year. The annual fee billed has reduced overall from approximately $238K at the start of the LTRA to $175K over the length of the contract.

FIGURE 6: ANNUAL SYSTEM LTRA COSTS



For 2003, the program cost is anticipated to increase for transfer of the Site from the Federal Government to the State of New Hampshire and for some preliminary site closure activities. Currently the site is staffed by one full-time plant operator. The operator monitors daily activity, checks the status of the process equipment. Performs daily site walkthroughs and performs basic lab tests to ensure system is operating properly. The operator also performs preventative and routine maintenance of the facility equipment. The facility maintenance records are maintained on site in the card filing system and the daily log book. Access to the facility is restricted by a perimeter fence. To date, no unauthorized access of the facility or grounds has been reported.

The historic water quality data indicated a significant reduction in contaminants in the groundwater flow system in several areas of the site. After nine years of operation of the groundwater collection and treatment system, the VOCs detected in the groundwater have been significantly reduced or eliminated in certain areas. Currently, twenty-three groundwater-monitoring wells and extraction wells at the Site are sampled on a semi-annual basis and three additional wells are sampled once per year in the fall sample event. The monitoring wells are sampled in the spring and fall. The wells are sampled using minimum stress/low flow sampling methodology. The groundwater sampling is primarily conducted by a team from the NHDES.

The GCTF was designed to operate until cleanup goals are achieved. However, USEPA and NHDES are currently evaluating the long-term performance of the groundwater extraction and treatment system as this system reduces in cost efficiency due to the decreasing groundwater concentrations. Other alternative remedial options will need to be considered in the near future that will allow site cleanup levels to be met in the most cost-effective manner while remaining protective of human health and the environment. Should the system be shut down prior to having achieved the cleanup goals set for the groundwater, long-term monitoring will be conducted to ensure that the remedial efforts are protective of human health and the environment. In addition, institutional controls would be required to restrict the use of on-site groundwater.

5. PROGRESS SINCE LAST FIVE-YEAR REVIEW

The previous five-year review for the site was completed in September of 1997. No areas of non-compliance were identified in this 1997 review. It was concluded at that time that the remedy remained protective of human health and the environment. The only recommended follow-up actions from the 1997 review were to continue the operation of the groundwater pump and treatment.

Since 1997, progress in cleaning up the Site has been ongoing. As discussed in Section 6.4, concentrations of contaminants in the groundwater have been significantly reduced and the overall plume size has diminished substantially in aerial extent.

6. FIVE-YEAR REVIEW COMPONENTS

6.1 ADMINISTRATIVE COMPONENTS

The USEPA, the lead agency for this 2003 five-year review, notified the NHDES in mid-2002 of its intention to contract with Woodard & Curran, Inc. to assist in the preparation of this five-year review report. The review was conducted between September of 2002 and March 2003 per requisition number HBS-02 QT-MA-02-000252 under the Contract No. GS-10F-0068M. This order for services was issued on August 23, 2002 by Katonya Best, USEPA Contracting/Ordering Officer. The review is being conducted at the direction of USEPA's Remedial Project Manager (RPM) Cheryl Sprague. Tom Andrews of the NHDES has served as part of this review team.

6.2 COMMUNITY INVOLVEMENT

USEPA issued a press release on November 5, 2002 that was published in the Manchester Union Leader and on the USEPA website (press release # 02-11-2) announcing USEPA's review of the KES Site cleanup. The press release encouraged public participation. There is no established Community Advisory Group. To date, USEPA and NHDES have received little participation or involvement from the local community regarding the current five-year review. Key Site-related documents are available at the Harvey-Mitchell Memorial Library in Epping, New Hampshire. According to library staff, there has been only limited use of these documents.

6.3 DOCUMENT REVIEW

This evaluation included a review of all relevant documents including decision documents, work plans, and various monitoring reports. A complete list of these documents is provided in Appendix A.

6.4 DATA REVIEW

6.4.1 Source Control

As discussed above, the pre-design field studies indicated that natural attenuation and migration to site groundwater had reduced concentration of contaminants in source soils to below the cleanup goals, therefore no source control remedy was implemented. As discussed previously, the NHDES lined the former lagoon to stockpile soils generated during remedial construction. No additional action for these soils has been conducted to date.

6.4.2 Management of Migration

Historic results of groundwater monitoring conducted between June 1994 and October 2002 were reviewed. Cleanup standards were set in the ROD for benzene (5 ug/l), 1,2-dichlorethane (5 ug/l), 1,1-dichloroethylene (7 ug/l), trichloroethylene (5 ug/l), and tetrachloroethylene (5 ug/l).

Concentrations of the five VOCs targeted for cleanup at the site in the 1988 ROD (i.e., benzene, PCE, TCE, 1,2-DCA, and 1,1-DCE) have been fluctuating but have generally decreased over the period of remediation, as illustrated in the total VOC contaminant distributions in Figures 3 through 5 and presented in the Mann Kendal trend tests summarized in Table 3. In general, four limited areas of the site do not currently meet the cleanup standards. Two areas are located off-site and two areas are located on-site. The two off-site areas are located southeast of the site near monitoring well CDM-12 (see Figure 5).

The second off-site area is located northwest of the site near monitoring well EMW-3 (see Figure 5). The on-site areas are located south of the treatment plant near wells Q1 and EMW-1 and north of the plant near CW-3B. Overall, generally decreasing trends in total VOCs have been observed across the Site (W&C, 2002), as illustrated by the October 2001 Mann-Kendal trend analysis (see Table 3). The concentration of total VOCs in the on-site area directly south of the treatment plant appears to be relatively stable and has not changed significantly in a number of years (W&C, 2002). While groundwater still exceeds the ROD standards at a number of sampling locations on the Site, the remedy has effectively reduced concentrations of contaminants.

In addition to the five groundwater COCs identified in the 1988 ROD, the on-going monitoring program has identified additional VOCs in exceedence of applicable MCLs and/or NHDES standards. As illustrated in **Figure 7**, several contaminants were detected in 2002 in exceedence of the USEPA MCLs in addition to the five current COCs. These compounds include 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1,-DCA), chloroethane, cis-1,2-dichloroethylene (cis-1,2-DCE), diethyl ether, methylene chloride, and tetrahydrofuran (THF). In addition, an evaluation of these additional VOCs since the last five-year review (1997 to October 2002) was conducted. For the purposes of this review, these chemicals have been identified as compounds of potential concern (COPCs) for the groundwater at the Site. As indicated in the **Table 4**, the total list of COPCs at the site include arsenic, methylene chloride, methyl ethyl ketone (MEK), 1,2-dichloropropane, vinyl chloride, 1,1-dichloropropane, toluene, THF, 1,1,1-TCA, cis-1,2-DCE, and 1,1-DCA. The majority of the chemicals that can now be identified as a contaminants of concern were not listed as such at the time of the ROD due to the fact that these chemicals mostly represent breakdown products of the original chemicals. This indicates that some natural attenuation processes are occurring at the site.

6.5 SITE INSPECTION

A site inspection was conducted on November 4, 2002 with representatives from USEPA, NHDES, and NHDES' site contractor. The inspection included a site walkover focused on the treatment plant, extraction wells, extraction trench, monitoring wells, closed lagoon, and site fence. The site fence continues to secure access to the Site. The inspection of the monitoring wells revealed that not all monitoring wells have locks, and a number of wells require maintenance of the surface protective casings, or should be considered for future removal. The wellhead manholes at the extraction wells were observed to be functioning and in good condition. There has been no reported vandalism or trespassing on the site. Stressed vegetation was not observed during the site inspection.

The treatment plant was observed to be in excellent condition. Chemicals used appeared to be properly stored. The sludge produced at the plant was of limited volume and was properly stored. The treatment plant was neat and free from clutter. Sampling ports were not clearly marked, but were functional and well maintained.

Site paperwork was available and well organized. The necessary operations and maintenance manuals were readily available and up to date. Groundwater monitoring records, discharge compliance records, and daily access logs were all readily available.

No apparent land use changes have taken place on-site since the 1997 five-year review. The only off-site land use changes observed at the time of the inspection was on an upgradient property used to recycle materials. It appears that the operations have expanded since the last inspection. This off-site change should not affect the performance of the remedy.

The site inspection report is included in Appendix B to this report.

EW-95-7 CONSTITUENT	3/14/02	5/16/02	7/16/02	8/14/02	9/23/02	10/16/02	MCL
1,1-DCE	17	13	12	10	9	13	7
PCE	5J	4.2	6	ND	10	10	5

EW-97-3 CONSTITUENT	7/16/02	10/16/02	MCL
1,1-DCE	10	ND	7
PCE	ND	6	5

EMW-1 CONSTITUENT	5/16/02	MCL
1,1-DCE	96	7
1,2-DCA	22	5
BENZENE	13	5

Q2 CONSTITUENT	5/15/02	5/15/02 Duplicate	MCL
1,1-DCE	32	35	5

KES-2D CONSTITUENT	5/16/02	MCL
1,1-DCE	16	7

CDM-12 CONSTITUENT	5/14/02	MCL
TCE	6.8	5

EW-2 CONSTITUENT	3/14/02	MCL
PCE	5J	5

MW-A CONSTITUENT	5/16/02	MCL
1,1-DCE	120	7

Q1 CONSTITUENT	5/15/02	MCL
1,1-DCE	180	7
1,2-DCE	25	5
TCE	18	5

EW-97-2 CONSTITUENT	3/14/02	5/16/02	7/16/02	9/23/02	10/16/02	MCL
1,1-DCE	12	66	9	ND	ND	7
1,2-DCA	ND	5.5	ND	ND	ND	5
PCE	5	7.3	13	7	29	5
TCE	ND	6.7	ND	ND	ND	5

CW-3B CONSTITUENT	5/15/02	5/15/02 Duplicate	MCL
BENZENE	6.6	6.6	5

EW-97-1 CONSTITUENT	7/16/02	8/14/02	9/23/02	MCL
PCE	6	24	36	5

MW-Z CONSTITUENT	5/15/02	MCL
PCE	15	5

LEGEND

- 2002 SAMPLING LOCATIONS
- MONITORING WELLS CURRENTLY NOT SAMPLED
- WATER WELL
- PROPERTY LINE
- APPROXIMATE RESIDENTIAL PROPERTY BOUNDARY
- EDGE OF GRAVEL ACCESS ROAD
- EDGE OF PAVED ROAD
- STREAM
- EXISTING BUILDING

J – ESTIMATED
ND – NOT DETECTED
MCL – MAXIMUM CONTAMINANT LEVEL (JULY 2002)

EXETER ROAD (OLD RT. 101)
LOT #55
LOT #54
LOT # 53
LOT #52
CDM-17
CDM-2B
CDM-15
CDM-6
CDM-16
CDM-7
EW-5
CDM-3B
CDM-8
CDM-3A
CDM-4A
EW-3
EMW-3
CDM-1A
SS-2
CDM-10
EW-95-2
EW-4
CDM-9
EW-95-7
CW-2A
CW-2C
KES-2A
KES-2B
CW-5C
CW-5A
CW-5B
CDM-11
SS-4
EMW-2
EMW-1
EW-97-3
MW-X
KES-4A
EW-97-2
Q3
Q2
EW-97-1
MW-C
Q1
CW-3B
MW-Z
BEW-1
KES-2D
MW-A
CW-3A
CW 6A & 6C
CDM-5A
CDM-5B
CW-4C
CW-4A
FORMER LAGOON AREA
CDM-18
EW-1
SS-1
CDM-12
EW-2
KES-5A
CW-1A & 1C

WOODARD & CURRAN
Engineering · Science · Operations
PORTLAND, MAINE
1-800-426-4262

2002 MCL EXCEEDENCES IN GROUNDWATER

DESIGNED BY: JMM CHECKED BY: FLC
DRAWN BY: PFF FILE: 93424011-7/5yr/interim

KEEFE ENVIRONMENTAL SERVICE SITE
EPPING, NEW HAMPSHIRE

FIVE-YEAR REVIEW

JOB NO: 217000.01
DATE: MARCH 2003
SCALE: 1" = 125'

FIGURE 7

TABLE 4

SUMMARY OF GROUNDWATER DETECTIONS IN EXCEEDENCE OF MCLS

Parameter	1997-2002 Frequency of Detection	1997-2002 Maximum Detection	2002 Maximum Detection	2002 MCL
Arsenic[1]	9/16	**140**	NS	**10**
Methylene chloride	2/337	**170**	4 J	5
Methyl ethyl ketone	3/311	**32,000**	ND	170[3]
1,2-Dichloropropane	8/337	**30**	ND	5
Vinyl chloride	8/339	**6.3**	**6.3**	2
1,1-Dichloropropene[2]	17/225	270	ND	NA
Toluene	21/345	**1,200**	ND	1000
Tetrahydrofuran	44/191	**1,100**	**360**	154[3]
Benzene	71/345	**74**	**13**	5
Tetrachloroethylene	79/345	**74**	**36**	5
1,2-Dichloroethane	87/352	**42**	**5.5**	5
Trichloroethylene	89/351	**31**	**18**	5
1,1,1-Trichloroethane	89/352	**530**	44	200
cis-1,2-Dichloroethylene[4]	101/267	48	32	70
1,1-Dichloroethylene	213/353	**330**	**36**	7
1,1-Dichloroethane	243/356	**630**	**180**	81[3]

NOTES:

MCL - Maximum Contaminant Level

NA - No standard available

NS- Not sampled

ND - Not detected

Concentrations in micrograms per liter.

BOLD indicates exceedance of MCL/GW-1.

Bold italics indicates 1988 ROD indicator compounds

[1]Arsenic analyzed for in groundwater only in 1989-1990; however, this constituent was reevaluated as a COPC due to the decrease in the MCL since the signing of the 1988 Record of Decision (ROD).

1,1-Dichloropopene does not have an MCLs or GW-1 standard, however this compounds should be evaluated as COPCs due to its frequency of detection between 1997 and 2002.

[3]MCL not available; NHDES GW-1 standard is presented.

[4]The maximum detected concentration of cis-1,2,-dichloroethylene did not exceed the MCL; however, should be evaluated as a COPC due to its high frequency of detection.

6.6 SITE INTERVIEWS

General discussions and observations were documented during the site inspection on November 4, 2002. Telephone interviews were conducted with other individuals. All individuals contacted during this five-year review are shown in Appendix C.

Mr. Thomas Andrews, NHDES Remedial Project Manager of the KES Site was interviewed during the site inspection on November 4, 2002 and again by phone on January 22, 2003. Mr. Andrews reported that the overall cleanup is progressing well and that the improvements made to the Site during the LTRA period are helping to bring the Site to closure as planned. Mr. Andrews also reported good communication between the State, LTRA contractor, Town of Epping, and nearby property owners. He indicated that the NHDES routinely samples and analyzes the residential wells and reports that the cooperation between homeowners and the sample staff is commendable. Mr. Andrews indicated that the State will continue to perform long-term monitoring of the site to ensure the remedial action is effective.

The Town of Epping Economic Development Coordinator, Mr. Jim Boyton, was also contacted during the interview process to solicit information regarding the Town's perception of the site cleanup progress. Overall, he reported good communication between the State, the site LTRA contractor and himself. Mr. Boyton expressed his appreciation of the clean-up efforts and emphasized the Towns desire to see the property cleaned up so that they could explore potential future uses of the site. Mr. Boyton stated that he has received contact from several parties interested in future use of the site. He requested that the communications between the State, LTRA contractor and himself continue as the remedial action progresses so he can develop plans for the site. He would like to explore options that enable future use without incurring future liability for the site.

Mr. Harvey King, facility operator for the site LTRA Contractor, Woodard & Curran, was interview during the site inspection and on several occasions after to obtain information regarding the ongoing site activities. He indicated that the facility continues to operate well and meet the compliance goals. He performs daily checks on the facility and surrounding property. To date, Harvey reported that the site receives very little public interest. He has had only a few site visitors that inquired about the site over the past several years. He maintains good relationship with the property abutters. He reported that no trouble or vandalism has occurred at the site since during the LTRA phase. Harvey reported that several improvements to the site have been accomplished to reduce chemical deliveries and secure site property.

The librarian at the Epping Town Library was also contacted during the document review process of the five-year review. The administrative record and site documents are available at the library. Library staff indicated that few individuals have accessed the documents.

The USEPA has received no response to date from the public regarding the publication of the press release in November 2002.

7. TECHNICAL ASSESSMENT

The following sections evaluate the OU-2 remedy based on its function in accordance with decision documents, its adherence to valid risk data and scenarios, and any other information that could have affected the remedy's protectiveness. The ARARs and To Be Considered (TBC) Guidance for the Site identified during the development of the ROD, along with current ARARs and TBCs, are provided in Appendix D of this report for reference.

This section was prepared consistent with the June 2001 Comprehensive Five-Year Review Guidance document. As such, it addresses the questions regarding the technical assessment as laid out in the Guidance document and presented in the subsections below. Because the source control remedial option as presented in the March 1988 ROD was deemed unnecessary based on pre-design field study soil analytical results, these questions are primarily applied to the groundwater management of migration portion of the remedy currently functioning at the site.

Based on the current review of the groundwater extraction system and current groundwater conditions at the Site, it has been concluded that the usefulness of the existing extraction system is limited. It is currently anticipated that the groundwater extraction system will be discontinued prior to the next five-year review in 2008. USEPA has planned that by September 2004 the USEPA-lead LTRA for the Site will be discontinued and NHDES will become the lead agency for the Site. At this time, it is anticipated that NHDES will transition the Site into a long-term Operation and Maintenance (O&M) program. If groundwater cleanup objectives have not been met at the time the groundwater extraction system is discontinued, institutional controls to restrict future groundwater use at the Site will need to be implemented and a groundwater management zone will need to be established. In addition, this administrative change may require an evaluation of a future trespasser or site worker scenario for the direct contact of the on-site soils, which will require the collection of current soil samples from the filled lagoon.

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

Yes.

Remedial Action Performance: A review of relevant project documents and the results of groundwater monitoring indicate that the current remedy is functioning as intended. Cleanup levels are expected to be met at the completion of the remedial action.

Monitoring Results: As described earlier in this report, concentrations of the five VOCs monitored at the site overall either meet the ROD cleanup goals or trend downward (except for two wells immediately adjacent to the treatment plant). Additionally, over the period of monitoring, the plumes at the site have been reducing in overall size and concentration, as illustrated in Figures 3 though 5 and Table 3.

LTRA/Costs: The LTRA costs for the last five years were summarized in Section 4.3 and Figure 6. In general, LTRA costs have decreased consistently since the last five-year review. The cost data indicates that approximately $160,000 and $175,000 was spent on LTRA during 2001 and 2002, indicating significant decreases in the program cost of $235,000 at the start of operations. These costs include the groundwater monitoring for the site.

Opportunities for Optimization: Optimization in the form of the installation of new extraction wells at optimized locations took place in 1997. Since that time additional improvements in groundwater quality have been noted (W&C, 2002). The groundwater monitoring network should be re-evaluated and the locations and number of wells included in the network modified based on agreement by the USEPA and NHDES. It may be possible to further reduce the number of monitoring wells routinely sampled based on review of the historical groundwater results.

Indicators of Remedy Problems: Based on the site inspections performed and the evaluation of the performance of the remedy, there are no remedy problems that can be identified which could lead to the remedy being not protective or suggest protectiveness is at risk unless changes are made.

Implementation of Institutional Controls: Institutional controls were not included as a component of the remedy. However, this five-year review has recommended the need to evaluate and implement institutional controls by September 21, 2004 based on the anticipated administrative change from the USEPA-lead LTRA program to a State-lead O&M program. Implementation of institutional controls at this time will be necessary to restrict future groundwater use at the site.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF REMEDY SELECTION STILL VALID?

Yes.

7.2.1 Review of Remedial Action Objectives

Remedial Action Objectives (RAOs) for groundwater were established in the 1988 Record of Decision (ROD) in part to eliminate or minimize the threat posed to the public health, welfare and environment from the current extent of contaminant migration at the Site. Cleanup levels, which are equivalent to Federal MCLs for drinking water, are presented in **Table 5** below for the five human health indicator compounds identified in the ROD as well as additional contaminants of concern detected since the last five-year review[1].

To date, none of these cleanup levels has changed since their issuance by USEPA in the 1988 ROD. Based on the most recent analytical data from 2002, Site groundwater concentrations of all human health indicator compounds listed in Table 5 continue to exceed their respective groundwater cleanup levels. However, the magnitude of these exceedences continues to decrease with time.

Soil collected during the installation of the remedial system was stock-piled in the former lagoon area which was lined by NHDES. Stormwater runoff from these stockpiled soils is collected and treated by the groundwater treatment system. However, these soils have not been fully characterized; therefore a quantitative risk evaluation has not been completed for the potential exposure to these soils. Because the

[1] Impacted soil at the Site has been excavated and is currently stockpiled on-site; however, perimeter fencing currently restricts access to this soil. Recent analytical results for surface water samples collected from the unnamed stream that runs through the site indicate that contaminants are not present in surface water at measurable concentrations. Therefore, soil and surface water were not evaluated in this 5-year review as current exposure pathways.

soil pile is located within the security fence there is no potential exposure and therefore there is no risk, however, if the site use were to change we will need to evaluate soil exposure pathways and potential risk will need to be evaluated.

TABLE 5: REMEDIAL ACTION PROGRESS FOR GROUNDWATER CONTAMINANTS

Contaminant	Groundwater Cleanup Level (parts per billion)	Maximum Detected Historic Groundwater Concentration 1988-2002 (parts per billion)	Maximum Detected Groundwater Concentration 2002 (parts per billion)
1988 ROD Contaminant of Concern			
Benzene	5	330	13
Tetrachloroethylene	5	1,045	36
Trichloroethylene	5	211	18
1,2-Dichloroethane	5	580	5.5
1,1-Dichloroethylene	7	1,954	180
Additional Contaminants of Potential Concern			
Arsenic	10	140	NA
Methylene chloride	5	1,230	4 J
Methyl ethyl ketone	170	32,000	ND
1,2-Dichloropropane	5	197	ND
Vinyl chloride	3	6.3	ND
1,1-Dichloropropene	NA	270	ND
Toluene	1000	1,200	ND
Tetrahydrofuran	154	1,900	360
1,1,1-Trichlorethane	200	3,500	44
cis-1,2-dichloroethylene	70	48	32
1,1-dichloroethane	81	2,405	180

NA = Not analyzed
ND = Not detected

7.2.2 Review of ARARS

The ARARs for the Site include the Federal MCLs and NHDES GW-1 Standards. No changes to these regulatory standards have been made to the five indicator compounds since 1997 during the previous 5-year review; however, MCLs and state drinking water standards for several compounds detected in groundwater have changed, as noted in Table D-1 (Appendix D).

Most notably, the arsenic standard, which is not in effect until 2006, has decreased to 10 ppb. New Hampshire GW-1 standards for carbon disulfide, diethyl ether, and MTBE have also changed but these compounds are not contaminants of concern at the site. For diethyl ether, a new standard of 1,400 µg/L may exist, but this compound has not been found to exceed this new standard at the site.

Additional State ARARs applicable to the Site include the following:

- **Hazardous Waste Rules** (Env-Wm 100-1000, October 2001, and
- **Rules Governing the Control of Air Pollution** (Env-A 100-1700, December 1995) Emissions from the groundwater treatment system air stripper are within the standards provided in these regulations.

In summary, the applicable ARARs have not changed significantly since the issuance of the 1988 ROD, such that the remedy for the Site would no longer be protective of human or environmental health.

7.2.3 Review of the Chemicals of Potential Concern (COPC)

In the 1986 risk characterization, a small subset of all detected compounds was chosen as "Human Health Indicator Compounds" based on their relative toxicity and concentrations. This list was expanded in the 1997 risk characterization; chemicals of potential concern (COPC) were selected based on a comparison of detected concentrations to ARARs and other State and Federal groundwater cleanup levels. Compounds with concentrations exceeding these applicable standards were chosen as COPC unless the frequency of detection was lower than 5%.

Available Site groundwater data from 1997 to September 2002 were evaluated in order to determine the current COPC at the Site. Summary statistics for compounds within this date range are presented in Table D-2. Generally, compounds detected in exceedence of MCLs or State standards at frequencies greater than 5% were retained as COPCs. Contaminants were screened out based on their frequency of detection and concentration; compounds detected at a frequency of less than 5% (for sample sizes greater than 20; USEPA, 1989) **and** less than the MCL or GW-1 standard were ruled out as COPC. In addition, compounds that did not have MCLs or GW-1 standards and were detected sporadically or infrequently (less than 5%) were also not retained as COPC. The COPC not included in the 1988 ROD, while they do not have ARARs, may need to be assessed at the completion of the remedy to ensure that risks associated with these contaminants are protective.

The revised list of COPCs, shown in Table D-2, contains all of the original COPCs in the 1997 risk characterization as well as the initial "human health indicator compounds", with the exception of ethylbenzene and nickel. There is no MCL for nickel; however, there is a current Drinking Water Equivalent Level (DWEL) of 700 ppb. Nickel has not been routinely analyzed for in groundwater sampling events since 1990. Data from historic sampling events indicate that nickel was generally present at concentrations below the DWEL, with the exception of a single historical detection of 1,160 ppb (less than twice the DWEL) in well Q-1. Historical concentrations of nickel in other Site wells ranged from non-detect (detection limit of 20 ppb) to 600 ppb. As site concentrations of nickel were generally below recommended drinking water guidelines, and as there is no known source of nickel at the site, nickel was ruled out as a COPC. Ethylbenzene was detected at a low frequency (1.8%) during 1997-2002, with a maximum concentration of 17 ppb, well below the MCL of 700 ppb.

The MCL for arsenic has changed from 50 ppb to 10 ppb since 1991. Historic concentrations of arsenic in groundwater from wells R (140 ppb), S (52 ppb) and X (60 ppb) exceed the new arsenic MCL. Therefore, arsenic was added as a COPC.

7.2.4 Changes in Exposure Assessment

Groundwater at the Site remains a medium of concern, although there is very limited potential for exposure. No institutional controls have been implemented at the Site. However, as described below, the Site is currently fenced and vacant and is typically only accessed by the trained treatment plant operator. Exposure pathways evaluated in the 1986 and 1997 risk characterizations included groundwater ingestion by hypothetical future site residents and commercial/industrial workers and dermal/inhalation exposures from showering for hypothetical future Site residents.

The Site is unoccupied (with the exception of the groundwater treatment facility, which has one full-time maintenance employee) and is currently surrounded by chain-link fencing and is locked. On-site groundwater used within the site facility is from a deep bedrock well that does not contain site-related contaminants. There is the potential for volatilization of contaminants from the shallow groundwater aquifer into the indoor air of the treatment building; however, this pathway is unlikely to be of significant concern since: 1) the building is of slab-on-grade construction; 2) the building is relatively new (and hence has an intact slab); 3) the depth to groundwater in that area is approximately 15 feet below grade; and 4) concentrations of COPC in the shallow aquifer in that area are relatively low.

Residences are located south of the site along Exeter Road. However, both historic and recent analytical results from monitoring wells placed near these residences confirm that contamination has not migrated to these water supply wells, and that the remedial system has contained groundwater contamination to the site property.

Based on this evaluation, there have been no changes to the exposure assessment for groundwater that would significantly affect the protectiveness of the remedy.

However, exposure assumptions for groundwater and soil may change in the future. On September 21, 2004 the USEPA-lead LTRA for the Site will be discontinued and NHDES will become the lead agency for the Site. At this time, it is anticipated that NHDES will transition the Site into a long-term O&M program. If groundwater cleanup objectives have not been met at this time, institutional controls to restrict future groundwater use at the Site will need to be implemented and a groundwater management zone will need to be established. In addition, this administrative change may require an evaluation of a future trespasser or site worker scenario for the direct contact of the on-site soils, which will require the collection of current soil samples from the filled lagoon.

7.2.5 Changes in Toxicity Data

Toxicity values used in the 1997 risk characterization were compared with current values obtained from USEPA sources. This comparison is presented in Table D-3. Toxicity values of several COPCs (1,1,1-TCA; benzene; 1,2-DCE; TCE) have changed since 1997. Because there is no current exposure to groundwater, these changes are unlikely to alter the protectiveness of the remedy.

7.2.6 Changes in Risk Assessment Methods

As part of this 5-year review, the risk characterizations conducted in 1986 and 1997 were reviewed to evaluate whether changes in risk assessment practices have been made since the 1988 ROD was signed, which may affect the protectiveness of the cleanup remedy. Two significant changes in risk assessment methods have occurred since the 1997 risk characterization completed for the site, including the methodology used to evaluate migration of volatiles from the subsurface to indoor air; and the use of

central tendency and reasonable maximum exposure assumptions, rather than just upper-bound or worst-case exposure assumptions.

Indoor air risks were not evaluated in either the 1986 or 1997 risk characterizations completed for the Site. However, as previously mentioned in Section 2.4, risks from this exposure pathway are likely negligible at the Site. Furthermore, since drinking water standards were used as RAOs, and the highest levels of COPCs at the Site are typically limited to deeper overburden and/or bedrock aquifers, it is unlikely that RAOs would decrease based on inclusion of this exposure pathway.

Upper-bound or worst-case exposure parameters were generally used in risk assessments conducted previously at the Site. Current USEPA guidance, however, recommends the use of both central-tendency exposure (CTE) and reasonable maximum exposure (RME) to evaluate potential risks. Additionally, updated exposure information is available. Exposure parameters used to evaluate worst-case scenarios in the 1997 risk characterization are compared to current assumptions in Table 4 of Appendix D.

Ecological evaluations were conducted during both RIs (1985 and 1987) to evaluate the potential impact to biota at which time it was determined to be low and not a risk to the natural environment. Therefore no additional remedy was required. Completion of the OU-1 remedial action (e.g., closing the former lagoon) has addressed the potential exposure pathways identified in the 1988 ROD and has further reduced or eliminated future risk to ecological receptors. While the ecological assessment methods have evolved since the original RI was completed, the current data indicates that the remedy remains protective of the environment.

In summary, although changes in risk assessment methods have been made since the 1997 risk characterization to both human health and ecologic receptors, none of these changes will affect the protectiveness of the remedy.

7.2.7 Expected Progress toward meeting Remedial Action Objectives (RAOs)

The Site groundwater treatment system, which has been in operation continuously since its initial startup, has been effective in reducing the overall mass of contaminants, as indicated by analytical results from groundwater monitoring events at the site, summarized in Table D-5 and illustrated in Figure 3 though 5. Across the site, concentrations of chlorinated VOCs have generally shown a decreasing trend with time, with the exception of vinyl chloride; however, this constituent was detected in only 8 of 339 samples (2%), and was not detected during the most recent sampling events (2001-2002). Concentrations of several nonchlorinated VOCs (toluene, MEK, and acetone) have increased within the past 5 years, although neither MEK nor acetone was detected in 2001-2002 samples.

Analytical results from the most recent sampling events (i.e., 2001-2002) indicate that VOCs continue to exist in groundwater in the central and northwestern portions of the site at concentrations exceeding cleanup levels set in the 1988 ROD for the five human health indicator compounds. However, these exceedances are limited to the site, and therefore do not pose a significant risk beyond the site boundaries. In addition, several additional VOCs have been detected in groundwater at the site that exceeded applicable MCLs and/or State standards and should be evaluated further as COPCs (see Table D-2).

Based on a qualitative evaluation of groundwater quality and potential exposure pathways, it was determined that the remedy is functioning as intended in the ROD. Therefore, it is concluded that the present remedial system is adequately protective of human and environmental health.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No. Currently, concentrations of contaminants exceed ROD target cleanup goals. Overall, a downward trend in concentrations of ROD targeted contaminants has been observed since the last five-year review indicating that the remedy continues to function as intended. The remedy remains protective, and no other information has been discovered that would call into question the protectiveness of the remedy at this time.

8. ISSUES

The Treatment System is currently operating under a grant from USEPA that is administered by the NHDES. As discussed earlier in this report, concentrations of some COCs still remain at or above ROD target cleanup goals in limited areas of the site. Overall, a downward trend is observed for groundwater COCs indicating that the remedy has been successful in reducing the aerial extent of the groundwater plume, removal of significant contaminant mass, and been protective of human health and the environment. Monitoring of groundwater is planned to continue at the site.

Additional COPC (chemicals in groundwater, see Table 6) not identified during development of the 1988 ROD have been reviewed to evaluate possible additional risks to human health or the environment. Based on this review, these compounds do not appear to increase the risk at the site from the ingestion of the groundwater. However, a risk-based review of these chemical and potential exposure pathways should be conducted at the completion of the remedial action to establish protectiveness of the remedy.

Operation of the treatment plant is scheduled to continue at least through 2003. Land use has not changed significantly in the last five years however; institutional controls are not part of the remedy. If land use changes occur in the future under NHDES lead, institutional controls may become necessary. Specifically, on September 21, 2004 the USEPA-lead LTRA for the Site will be discontinued and NHDES will become the lead agency for the Site. At this time, it is anticipated that NHDES will transition the Site into a long-term O&M program. If groundwater cleanup objectives have not been met at the time the groundwater extraction system is discontinued, institutional controls to restrict future groundwater use at the Site will need to be implemented and a groundwater management zone will need to be established.

In addition, this administrative change may require an evaluation of a future trespasser or site worker scenario for the direct contact of the on-site soil stockpile, which will require additional soil characterization, possibly including collection of soil samples from the filled lagoon.

During the site inspection, several monitoring wells were observed to require maintenance and repair. These wells may represent a risk from vandalism or provide avenues for new contaminants to be introduced into the groundwater. Wells not currently in use for which there is no expected future use should be properly abandoned. Unsecured wells should be secured.

Advances in in-situ treatment technologies have been made since the 1997 implementation of the pump and treat remedy. A re-evaluation of alternate in-situ treatment technologies such as natural attenuation and chemical oxidation should be reviewed as possible cost effective alternatives to the existing pump and treat system.

9. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for the site are summarized in **Table 6** below.

TABLE 6: RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issue	Recommendations / Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Groundwater not at cleanup levels	Continue monitoring programs and conduct evaluation of alternative in-situ treatment technologies and/or source removal actions.	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	09/2003	No	No
Restrictions on future groundwater use	Evaluate Institutional Controls and structure to reflect potential future site conditions	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	9/21/2004	No	Yes
Damaged and unsecured wells	Repair damaged wells or properly close them, and secure unsecured wells	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	12/2004	No	No
Inactive monitoring wells	Formerly decommission wells	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	12/2004	No	No
New Groundwater COPC	Review against ARARs	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	9/21/2004	No	Yes
Soil Stockpile	Collect soil samples from stockpile; evaluate trespasser/future site worker direct contact exposure scenario	USEPA NHDES as of 9/21/2004	USEPA NHDES as of 9/21/2004	9/21/2004	No	Yes

10. PROTECTIVENESS STATEMENT

OU-1 - Source Control: The remedy at OU-1 has met soil clean up goals, is complete and therefore is protective of human health and the environment.

OU-2 – Management of Migration: The pump and treat remedy at OU-2 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

11. NEXT REVIEW

The next five-year review is scheduled for 2008.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	contaminant of potential concern
CTE	central-tendency exposure
DCA	dichloroethane
DCE	dichloroethylene
DWEL	Drinking Water Equivalent Level
EMW	extraction monitoring well
ESD	Explanation of Significant Differences
GCTF	Groundwater Collection and Treatment Facility
gpm	gallons per minute
GW	groundwater
KES	Keefe Environmental Services
LTRA	Long-Term Remedial Action
MCL	Maximum Contaminant Level
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
MSL	Mean Sea Level
MW	monitoring well
NCP	National Contingency Plan
NA	not applicable
ND	not detected
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
NS	not sampled
O&M	operation and maintenance
OU	operable unit
PCE	tetrachloroethylene
ppb	parts per billion
RAO	remedial action objective
RI	Remedial Investigation
ROD	Record of Decision

RPM	Remedial Project Manager
RME	reasonable maximum exposure
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethylene
THF	tetrahydrofuran
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
VEES	vacuum enhanced extraction system

APPENDIX A: DOCUMENT REVIEW LIST/REFERENCES

KEY DOCUMENTS REVIEWED/REFERENCES CITED

Camp Dresser & Mckee, 1986. *Supplemental Remedial Investigation Report, Keefe Environmental Services, Epping New Hampshire*. September 1986.

Tighe & Bond, 1985. *Remedial Investigation Report, Keefe Environmental Services Hazardous Waste Site, Epping, New Hampshire*. Revised: April 1985.

USEPA, 1993. *Keefe Environmental Services Five Year Review*. USEPA Region I, Office of Site Remediation and Restoration. February 1993.

USEPA, 1997. *Keefe Environmental Services Five Year Review*. USEPA Region I, Office of Site Remediation and Restoration. September 1997.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, OSWER Directive 9355.7-03B-P. June 2001.

USEPA, 2002. Keefe Environmental Services, Site Information. Record of Decision Web-site. http://www.epa.gov/oerrpage/superfund/sites/rodsites/010114.html. Accessed November 11, 2002.

Woodard & Curran, 1994. *Environmental Monitoring Program – Keefe Environmental Services Site, Epping, New Hampshire*. August 1994

Woodard & Curran, 1994. *Optimization Evaluation for Optimizing the Groundwater Extraction System and Wastewater Discharge System for the Keefe Site, Epping, NH.* November 1994.

Woodard & Curran, 1996. *Environmental Monitoring Program, Revision 1 – Keefe Environmental Services Site, Epping, New Hampshire.* June 1996

Woodard & Curran, 1998. *1998 Groundwater Quality Evaluation for the Keefe Environmental Services Site, Epping, New Hampshire*. January 1998.

Woodard & Curran, 1998. *Annual Operating Report for the Keefe Environmental Services Site, Epping, New Hampshire.* August 1998.

Woodard & Curran, 1999. *1999 Groundwater Quality Evaluation for the Keefe Environmental Services Site, Epping, New Hampshire*. February 1999.

Woodard & Curran, 1999. Annual Operating Report for the Keefe Environmental Services Site, Epping, New Hampshire. August 1999.

Woodard & Curran, 2000. *2000 Final Groundwater Quality Evaluation for the Keefe Environmental Services Site, Epping, New Hampshire*. August 2000.

Woodard & Curran, 2000. *Annual Operating Report for the Keefe Environmental Services Site, Epping, New Hampshire.* August 2000.

Woodard & Curran, 2002. *2001 Groundwater Quality Evaluation for the Keefe Environmental Services Site, Epping, New Hampshire*. March 2002.

Woodard & Curran, 2001. *Annual Operating Report for the Keefe Environmental Services Site, Epping, New Hampshire.* August 2001.

APPENDIX B: SITE INSPECTION REPORT

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Keefe Environmental Services	**Date of inspection: 11/04/02**
Location and Region: Epping, NH Region 1	**EPA ID:NHD092059112**
Agency, office, or company leading the five-year review: USEPA	**Weather/temperature:**

Remedy Includes: (Check all that apply)

Landfill cover/containment	Monitored natural attenuation
Access controls	Groundwater containment
Institutional controls	✓Vertical barrier walls
✓Groundwater pump and treatment	
Surface water collection and treatment	

Other_____

_____

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Dave Dedian (Name) Project Manager (Title) 11/04/02 (Date)
   Interviewed at site at office by phone Phone no. (207) 774-2112
   Problems, suggestions; Report attached. No problems noted.

2. **O&M staff** Harvey King (Name) Plant Manager (Title) 11/04/02 (Date)
   Interviewed ✓ at site at office by phone Phone no. (603) 624-8700
   Problems, suggestions; Report attached No problems noted.

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency NHDES
Contact Tom Andrews (Name) RPM (Title) 11/04/02 (Date) _____ (Phone no.)
Problems; suggestions; Report attached _____
_____

Agency USEPA
Contact Cheryl Sprague (Name) RPM (Title) 11/04/02 (Date) _____ (Phone no.)
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; Report attached _____
_____

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

O&M manual	✓Readily available	Up to date	N/A
As-built drawings	✓Readily available	Up to date	N/A
Maintenance logs	✓Readily available	✓Up to date	N/A

Remarks O&M Manual not up to date, does not reflect new wells installed in 1999. As-builts not updated to reflect extraction wells installed in 1995.

2. **Site-Specific Health and Safety Plan** ✓Readily available ✓Up to date N/A
   Contingency plan/emergency response plan ✓Readily available ✓Up to date N/A
   Remarks_____

3. **O&M and OSHA Training Records** ✓Readily available ✓Up to date N/A
   Remarks_____

4. **Permits and Service Agreements**

Air discharge permit	Readily available	Up to date	✓ N/A
Effluent discharge	Readily available	Up to date	✓ N/A
Waste disposal, POTW	Readily available	Up to date	✓N/A
Other permits_____	Readily available	Up to date	✓N/A

Remarks_____

5. **Gas Generation Records** Readily available Up to date ✓N/A
   Remarks_____

6. **Settlement Monument Records** Readily available Up to date ✓N/A
   Remarks_____

7. **Groundwater Monitoring Records** ✓Readily available ✓Up to date N/A
   Remarks_____

8. **Leachate Extraction Records** Readily available Up to date ✓N/A
   Remarks_____

9. **Discharge Compliance Records**

Air	Readily available	Up to date	✓ N/A
Water (effluent)	✓Readily available	✓Up to date	N/A

Remarks_____

10. **Daily Access/Security Logs** ✓Readily available ✓Up to date N/A
    Remarks_____

IV. O&M COSTS

1. **O&M Organization**
   State in-house ✓Contractor for State
   PRP in-house Contractor for PRP
   Federal Facility in-house Contractor for Federal Facility
   Other_____
   _____

2. **O&M Cost Records**
   Readily available Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate_____ ✓Breakdown attached

   Total annual cost by year for review period if available

   From_____ To_____ _____ ✓Breakdown attached
   Date Date Total cost
   From_____ To_____ _____ ✓Breakdown attached
   Date Date Total cost
   From_____ To_____ _____ ✓Breakdown attached
   Date Date Total cost
   From_____ To_____ _____ Breakdown attached
   Date Date Total cost
   From_____ To_____ _____ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____
   _____
   _____
   _____
   _____
   _____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map ✓Gates secured N/A
   Remarks No damage observed to fences.

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
   Remarks No trespassing signs posted on fences.

C. Institutional Controls (ICs)

✓N/A

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented Yes No ✓N/A
Site conditions imply ICs not being fully enforced Yes No ✓N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date Yes No ✓N/A
Reports are verified by the lead agency Yes No ✓N/A

Specific requirements in deed or decision documents have been met Yes No ✓N/A
Violations have been reported Yes No ✓N/A
Other problems or suggestions: Report attached

_____
_____
_____
_____

2. **Adequacy** ICs are adequate ICs are inadequate ✓N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** Location shown on site map ✓No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ✓N/A
Remarks_____
_____

3. **Land use changes off site** N/A
Remarks Expansion of recycling property (ERCO).

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map ✓Roads adequate N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS Applicable ✓N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** Location shown on site map Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks Low shrubs and weeds, some grass, no standing water observed. 25+ of soil cover over 8' trench spoils with impermeable liner beneath.

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks_____
   _____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ✓Wet areas/water damage not evident
   Wet areas Location shown on site map Areal extent_____
   Ponding Location shown on site map Areal extent_____
   Seeps Location shown on site map Areal extent_____
   Soft subgrade Location shown on site map Areal extent_____
   Remarks_____
   _____

9.	**Slope Instability** Slides Areal extent_____ Remarks_____	Location shown on site map	No evidence of slope instability	
B. Benches	Applicable ✓N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1.	**Flows Bypass Bench** Remarks_____	Location shown on site map	✓N/A or okay	
2.	**Bench Breached** Remarks_____	Location shown on site map	✓N/A or okay	
3.	**Bench Overtopped** Remarks_____	Location shown on site map	✓N/A or okay	
C. Letdown Channels	Applicable ✓ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1.	**Settlement** ✓N/A Areal extent_____ Remarks_____	Location shown on site map Depth_____	No evidence of settlement	
2.	**Material Degradation** ✓N/A Material type_____ Remarks_____	Location shown on site map Areal extent_____	No evidence of degradation	
3.	**Erosion** ✓N/A Areal extent_____ Remarks_____	Location shown on site map Depth_____	No evidence of erosion	

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ No obstructions
Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance ✓N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance ✓N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance ✓N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled ✓Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____
_____

5. **Settlement Monuments** Located Routinely surveyed ✓N/A
Remarks_____
_____

E. Gas Collection and Treatment Applicable ✓N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks_____
   _____

F. Cover Drainage Layer Applicable ✓N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds Applicable ✓ N/A

1. **Siltation** Areal extent_____ Depth_____ N/A
   Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** Functioning N/A
   Remarks_____
   _____

4. **Dam** Functioning N/A
   Remarks_____
   _____

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** Location shown on site map Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ✓Applicable N/A

1. **Siltation** Location shown on site map ✓Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** Location shown on site map N/A
   ✓Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** Location shown on site map ✓Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ✓Functioning N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ✓Applicable N/A

1. **Settlement** Location shown on site map ✓Settlement not evident
   Areal extent_____ Depth_____
   Remarks HDPE 10' deep.

2. **Performance Monitoring** Type of monitoring_____
   Performance not monitored
   Frequency_____ Evidence of breaching
   Head differential_____
   Remarks Sometimes overflow (to surface) occurs.

IX. GROUNDWATER/SURFACE WATER REMEDIES ✓Applicable N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ✓Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ✓Good condition ✓All required wells properly operating Needs Maintenance N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ✓Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ✓Readily available ✓Good condition Requires upgrade Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable ✓N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

C. Treatment System ✓Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   ✓Air stripping ✓Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others_____
   ✓Good condition Needs Maintenance
   Sampling ports properly marked and functional
   ✓Sampling/maintenance log displayed and up to date
   ✓Equipment properly identified
   Quantity of groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A ✓ Good condition Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   N/A ✓Good condition Proper secondary containment Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   N/A ✓ Good condition Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   N/A ✓Good condition (esp. roof and doorways) Needs repair
   ✓Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   ✓All required wells located Needs Maintenance N/A
   Remarks Some monitoring wells rusted, some locks missing.

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time ✓ Is of acceptable quality

2. Monitoring data suggests:
   ✓ Groundwater plume is effectively contained ✓ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

Properly secured/locked | Functioning | Routinely sampled | Good condition
All required wells located | Needs Maintenance | ✓N/A
Remarks_____
_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is designed to contain the contaminant plume by pumping and treating groundwater to ROD specified standards. Contaminant concentrations are declining but ROD cleanup goals have not been completely achieved. The remedy is functioning as intended and remains protective.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

_____
_____
_____
_____
_____
_____
_____
_____
_____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. No indicators of potential remedy problems were noted.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. System optimized in 1996, other options being analyzed.

APPENDIX C: SITE INTERVIEW LIST

TABLE C-1

SITE INTERVIEW LIST

KEEFE ENVIRONMENTAL SERVICES SUPERFUND SITE
FIVE-YEAR REVIEW

NAME / POSITION	ORGANIZATION / LOCATION	DATE
Thomas C. Andrews, Remedial Project Manager	NHDES	November 4, 2003 and January 22, 2003
Jim Boyton, Economic Development Coordinator	Town of Epping, NH	January 24, 2003
Harvey King, Plant Operator	Woodard & Curran	November 4, 2003
Cheryl Sprague	USEPA-Region 1	November 4, 2003

Interviews were conducted by both phone and in person.

APPENDIX D: RISK SUMMARY TABLES

Table D-1
Comparison of 1997 and 2002 State and Federal Drinking Water Standards for Chemicals Detected in Site Groundwater

KES Superfund Site
Epping, New Hampshire

Contaminant	1997 MCLs	2002 MCLs	NH GW-1 (1996)	NH GW-1 (2002)
Arsenic	50	10		
1,1,1-Trichloroethane	200	200		
1,1,2-Trichloroethane	5	5		
1,1-Dichloroethane	NA	NA	81	81
1,1-Dichloroethylene	7	7		
1,2-Dichloroethane	5	5		
Benzene	5	5		
c&t-1,2-Dichloroethylene	70	cis-1,2-Dichloroethylene: 70 trans-1,2-Dichloroethylene: 100		
Carbon disulfide	NA	NA	7	70
Chloroethane	NA	NA	NA	NA
Chloroform	100	100		
Cyclohexane	NA	NA	NA	NA
Dichlorobenzenes	75	o-Dichlorobenzene: 600 p-Dichlorobenzene: 75		
Diethyl ether	NA	NA		1,400
Ethylbenzene	700	700		
Methylene Chloride	5	5		
Methyl ethyl ketone	NA	NA	170	170
Methyl-t-butyl-ether	NA	NA	100	13
Nickel	NA	NA	100	100
Tetrachloroethylene	5	5		
Tetrahydrofuran	NA	NA	154	154
Toluene	1,000	1,000		
Trichloroethylene	5	5		
Trichlorofluoromethane	NA	NA	2,000	2,000
Vinyl chloride	2	2		
Xylenes	10,000	10,000		

NOTES:
NA = Not available.
All concentrations reported in parts per billion

Table D-2
Summary of Groundwater Analytical Data, 1997 - 2002

KES Superfund Site
Epping, New Hampshire

Parameter	1997-2002		2002
	Frequency of Detection	Maximum Detection	MCL
Arsenic [1]	9/16	**140**	**10**
Dichlorodifluoromethane	1/222	12	NA
o-Xylene	1/253	4	10,000
Carbon tetrachloride	1/337	4.5	NA
Methyl chloride	1/337	4	NA
Bromodichloromethane	2/322	2.6	NA
Chloroform	2/337	3.6	100
Methylene chloride	2/337	**170**	5
Bromobenzene	3/226	9.8	NA
Methyl ethyl ketone	3/311	**32,000**	170*
Methyl tert-butylether	3/337	5.9	13*
Trichlorofluoromethane	4/336	21	2000*
1,1,2,2-Tetrachloroethane	5/333	450	NA
Acetone	5/338	6,400	NA
1,2-Dichloroethene (total)	26-Jun	18	70
Ethylbenzene	6/337	17	700
1,2-Dichloropropane	8/337	**30**	5
Carbon disulfide	8/337	8.8	70*
Vinyl chloride	8/339	**6.3**	2
o-Dichlorobenzene	9/285	7.8	600
cis-1,3-Dichloropropene	16/337	39	NA
Chloroethane	16/340	29	NA
1,1-Dichloropropene	17/225	270	NA
Toluene	21/345	**1,200**	1,000
Tetrahydrofuran	44/191	**1,100**	154*
Benzene	71/345	**74**	5
Tetrachloroethylene	79/345	**74**	5
1,2-Dichloroethane	87/352	**42**	5
Trichloroethylene	89/351	**31**	5
1,1,1-Trichloroethane	89/352	**530**	200
Diethyl ether	89/352	72	1,400
cis-1,2-Dichloroethylene	101/267	48	70
1,1-Dichloroethylene	213/353	**330**	7
1,1-Dichloroethane	243/356	**630**	81*

NOTES:
MCL - Maximum Contaminant Level
*MCL not available; NHDES GW-1 standard is presented.
NA - No standard available
Concentrations in micrograms per liter.
BOLD indicates exceedance of MCL/GW-1.
BOLD/italics indicates current chemical of potential concern (COPC)

[1]Arsenic analyzed for in groundwater only in 1989-1990; however, this constituent was reevaluated as a COPC due to the decrease in the MCL since the signing of the 1988 Record of Decision (ROD).

Table D-3
Comparison of 1997 and 2002 Toxicity Values

KES Superfund Site
Epping, New Hampshire

Chemical of Potential Concern (as presented in 1997 Risk Characterization)	Chronic Oral RfD (mg/kg-d)				Oral Cancer Slope Factor $(mg/kg-d)^{-1}$			
	1997	Current Recommended Value	Source	Change?*	1997	Current Recommended Value	Source	Change?*
1,1,1-Trichloroethane	3.50E-02	2.80E-01	NCEA	Increase	NA	NA		
1,1-Dichloroethane	1.00E-01	1.00E-01	HEAST	Same	NA	NA		
1,1-Dichloroethene	9.00E-03	5.00E-02	IRIS	Increase	6.00E-01	No value	IRIS	No value
1,2-Dichloroethane	ND	3.00E-02	NCEA		9.10E-02	9.10E-02	IRIS	Same
Benzene	ND	3.00E-03	NCEA		2.90E-02	5.50E-02	IRIS	Increase
cis-1,2-Dichloroethylene	9.00E-03	1.00E-02	HEAST	Increase	NA	NA		
trans-1,2-Dichloroethylene	9.00E-03	2.00E-02	IRIS	Increase	NA	NA		
Diethyl ether	ND				ND	NA		
Methylene Chloride	6.00E-02	6.00E-02	IRIS	Same	7.50E-03	7.50E-03	IRIS	Same
Tetrachloroethylene	1.00E-02	1.00E-02	IRIS	Same	5.20E-02	5.20E-02	NCEA	Same
Tetrahydrofuran	2.00E-01	2.00E-01	NCEA	Same	ND	7.60E-03	NCEA	
Trichloroethylene	6.00E-03	3.00E-04	NCEA	Decrease	1.10E-02	4.00E-01	NCEA	Increase

Notes:
ND - Not determined
NA - Not applicable; compound not classified as carcinogen.
*An increase in RfD will result in a *decrease* in noncancer risks. An increase in the CSF will result in an *increase* in cancer risks.
NCEA = EPA-NCEA provisional value (as provided in EPA Region 3 RBC table).
HEAST = EPA, 1997
IRIS = Posted as of December, 2002.

Table D-4
Comparison of Exposure Parameters

KES Superfund Site
Epping, New Hampshire

Present Site Use of Groundwater*	Parameter	Units	Most Probable Case	Worst Case	Current Recommended Assumption	Comment/Reference
EPC	Exposure Point Concentration	mg/L	0	geometric mean	no evaluation**	EPCs were 0 for the most probable case because no indicator chemicals were detected in residential well water. The geometric mean concentration of in on site wells was used to represent worst-case EPCs.
BW	Average Body Weight	kg	not evaluated	70	no evaluation**	Risk was calculated based on an assumed continual exposure, and inhalation risks (for shower exposures) were assumed to be equal to ingestion risks.
IR	Ingestion Rate	L/day	not evaluated	2	no evaluation**	
Future Site Use of Groundwater	**Parameter**	**Units**	**Most Probable Case**	**Worst Case**		**Comment/Reference**
EPC	Exposure Point Concentration	mg/L	geometric mean	maximum	wellhead average***	Risk was calculated based on an assumed continual exposure, and inhalation risks (for shower exposures) were assumed to be equal to ingestion risks.
BW	Average Body Weight	kg	70	70	47.7 kg (child/adult)	
IR	Ingestion Rate	L/day	2	2	0.74 - 2 (child (1-10) and adult, respectively)	Child is assumed to have a reduced water ingestion rate (USEPA, 1999)

* Groundwater at the KES facility is not used as either a potable or non-potable water supply, except for one well located upgradient of the impacted aquifer. Risks were calculated for the residential properties abutting the Site, which have private wells.

** Given that no site-related chemicals have been detected in any of the wells currently used at or adjacent to the Site, this exposure pathway is considered to be incomplete and therefore does not warrant further evaluation.

*** Average concentration in wellhead per given time period (e.g., last 4 sampling rounds).

Table D-5

Summary of Site Groundwater Analytical Results: 1988 through 2002

KES Superfund Site
Epping, New Hampshire

Parameter	1988-1996		1997-2002		2001-2002		2002
	Frequency of Detection	Maximum Detection	Frequency of Detection	Maximum Detection	Frequency of Detection	Maximum Detection	MCL
Arsenic	9/16	**140**					10
Dichlorodifluoromethane	0/456		1/222	12	0//73	ND	NA
o-Xylene			1/253	4	0/75	ND	10,000
Carbon tetrachloride	0/465		1/337	4.5	1/106	4.5	NA
Methyl chloride	3/452	0.011	1/337	4	1/106	4	NA
Bromodichloromethane	1/456	65	2/322	2.6	0/89	ND	NA
Chloroform	11/350	0.017	2/337	3.6	1/106	3.6	100
Methylene chloride	11/456	**1230**	2/337	**170**	0/106	ND	5
Bromobenzene			3/226	9.8	3/75	9.8	NA
Methyl ethyl ketone	3/435	100	3/311	32000	0/106	ND	170*
Methyl tert-butylether	5/455	12	3/337	5.9	0/106	ND	13*
Trichlorofluoromethane	11/455	116	4/336	21	3/106	21	2000*
1,1,2,2-Tetrachloroethane	9/456	10426	5/333	450	4/102	110	NA
Acetone	9/447	398	5/338	6400	0/106	ND	NA
1,2-Dichloroethene (total)	141/453	**200**	26-Jun	18	28/106	32	70
Ethylbenzene	3/456	112	6/337	17	6/106	17	700
1,2-Dichloropropane	5/456	**197**	8/337	**30**	8/106	**30**	5
Carbon disulfide	5/446	8.3	8/337	8.8	0/106	ND	70*
Vinyl chloride	7/456	**3**	8/339	**6.3**	4/107	**4.1**	2
o-Dichlorobenzene			9/285	7.8	3/106	3.9	600
cis-1,3-Dichloropropene	5/456	472	16/337	39	5/106	24	NA
Chloroethane	29/456	72	16/340	29	4/106	6.7	NA
1,1-Dichloropropene			17/225	270	15/75	270	NA
Toluene	16/456	89.3	21/345	**1200**	7/106	**1200**	1,000
Tetrahydrofuran	122/451	**1900**	44/191	**1100**	10/61	**360**	154*
Benzene	123/456	**330**	71/345	**74**	16/106	**46**	5
Tetrachloroethylene	151/456	**1045**	79/345	**74**	25/106	**36**	5
1,2-Dichloroethane	135/456	**580**	87/352	**42**	17/106	**30**	5
Trichloroethylene	169/456	**211**	89/351	**31**	23/106	**18**	5
1,1,1-Trichloroethane	136/444	**3500**	89/352	**530**	17/106	61	200
Diethyl ether	87/451	110	89/352	72	16/105	21	1400*
cis-1,2-Dichloroethylene			101/267	48	28/106	32	70
1,1-Dichloroethylene	258/456	**1954**	213/353	**330**	65/104	**230**	7
1,1-Dichloroethane	273/456	**2405**	243/356	**630**	63/106	**210**	81*

Notes:

Results are based on all available data obtained from site groundwater sampling events, 1988-2002.

Blank spaces indicate parameter was not analyzed.

MCL - Maximum Contaminant Level

*MCL not available; NHDES GW-1 standard is presented.

BOLD indicates exceedance of MCL.

ND - Not detected.

NA - No standard available

Concentrations in micrograms per liter.